JULY 1928—THIRTY-FOURTH YEAR

JUL 3 1928

MACHINERY

THE INDUSTRIAL PRESS Publishers. 140-148 LAFAYETTE ST., NEW YORK

LANDEX

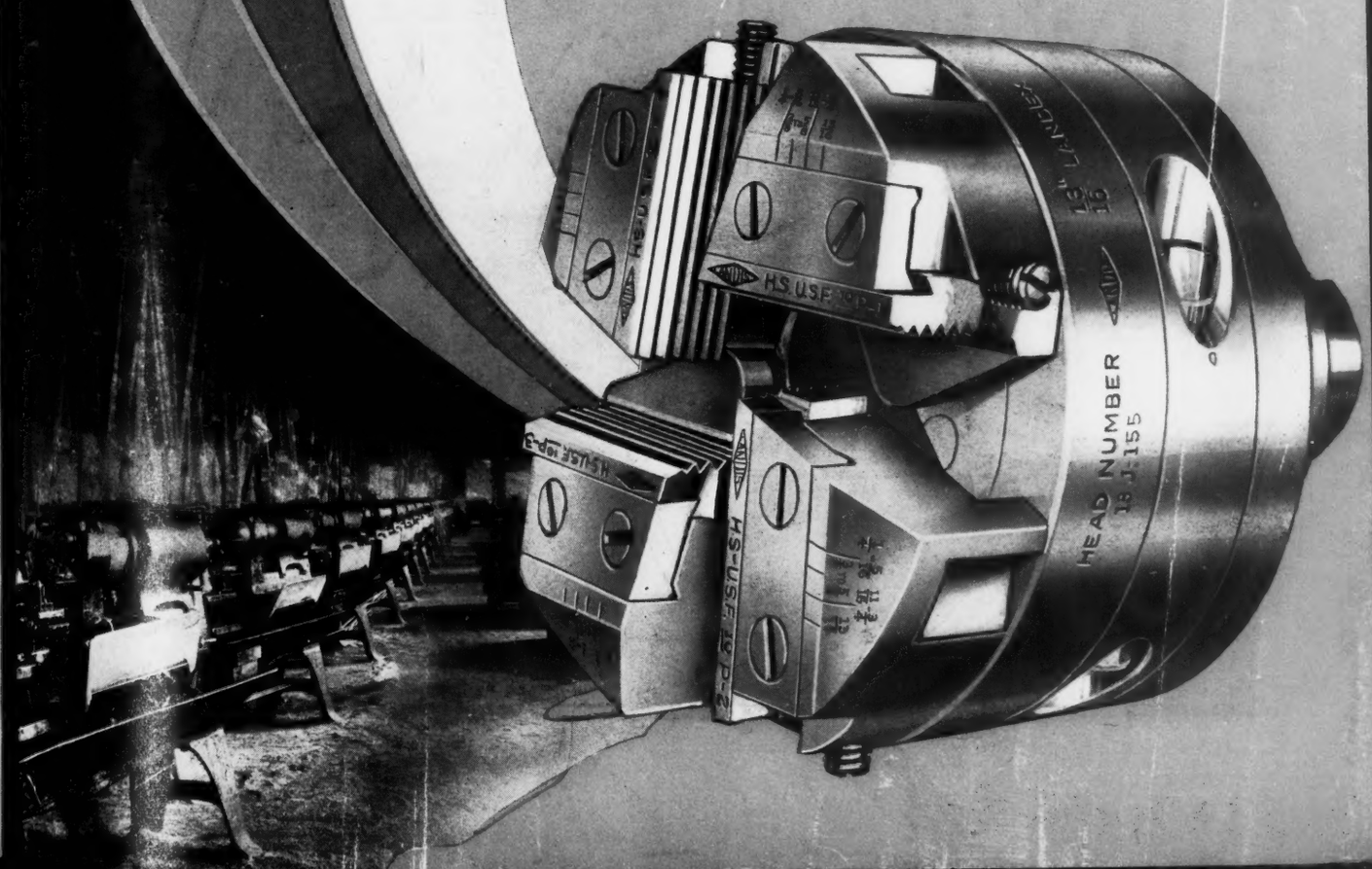
The New Landis Die Head

For Automatic Screw Machines

This new factor in Landis Threading Equipment rounds out a series of Die Heads covering every line of threading—Lanco for threading machines—Land-Matic for turret lathes—Landex for automatic screw machines.

Write for details of the Landis line of Die Heads.

Landis Machine Company, Inc.
Waynesboro, Pa.



So much depends upon the socket!

The socket is the vital part of a socket head cap screw and when it stops functioning the usefulness of the screw expires with it.

The socket is also the part of the screw that gets the most wear and abuse.

Just examine the design of the socket in a Bristo cap screw. Both the wrench and the socket have corresponding dovetail flutes, which interlock, giving the wrench a perfect hold on the screw. Actually the tendency is for the wrench to *contract* the head of the screw, rather than to spread it apart and round out the socket.

With this positive method of handling, Bristo cap screws can be set, adjusted and removed from the tightest set-up quickly.

A mechanic in the haste of setting up many cap screws often gives Bristos twice the pressure needed, but this only increases the grip of the wrench on the screw.

May we send you a 28-page illustrated catalog, showing the complete Bristo line? Write for No. 819-E, The Bristol Co., Waterbury, Conn.

GTD GTD GTD GTD GTD GTD GTD

When the No. 3 is used as a Universal Grinder a flexible drive shaft is utilized as shown. It can be removed or replaced in less than 60 seconds.

No Belts

THE No. 3 GTD Cutter Grinder needs no belts, nor gears.

Its ball bearing motor is located in the head, with rotor mounted on the main spindle. It is vibrationless, dust-proof and well ventilated. Motor troubles are unknown.

The motor head swivels up to 90°, which means quick set-up on many jobs.

Send for price list and bulletin today. Check against other grinders. We ask no more.

Other GTD Machine Tools

Hydroil Internal Grinders

Plain Grinders

Threading Machines

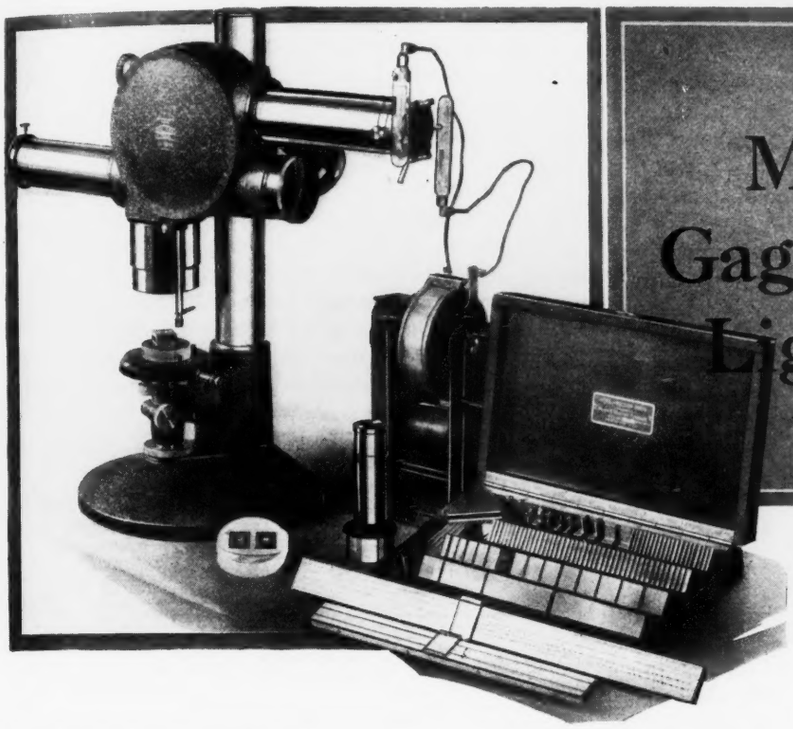
MACHINE TOOL DIVISION

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

New York—15 Warren St. Chicago—13 So. Clinton St.
Detroit—228 Congress St., W.
Canadian Plant—Greenfield Tap & Die Corporation of Canada, Ltd., Galt, Ontario.

MACHINERY

Volume 34 NEW YORK, JULY, 1928 Number 11



Measuring Gage-blocks by Light Waves

Application of a New Device for Precision Measurements

By F. KONIG
The George Scherr Co., New York City

PRECISION gage-blocks are almost universally employed today in interchangeable manufacture to control the accuracy of the work. They are used for checking all types of gages and other inspection devices. For such important service, obviously, it is necessary to be assured of the accuracy of the gage-blocks at all times. Their initial accuracy, as guaranteed by the manufacturer, may be impaired either by wear through use or by changes in length occurring with time.

Wear of Precision Gage-blocks

The amount of wear that takes place in gage-blocks can usually be expressed in 1/100,000 parts of an inch, depending, of course, on how much a block is used and whether it is employed as a working, inspection, or reference gage. Still, it is not uncommon to find blocks of sizes frequently used, such as 1/4 and 1/2 inch, worn more or less evenly as much as 0.0001 inch, in which case their value as precision blocks has disappeared.

Gage-blocks should, therefore, be periodically checked, and this is usually done against a reference set kept specially for the purpose. This comparative method is ordinarily accurate enough, provided a comparator is used which enables dependable measurements to be taken within 0.00001 inch as, for instance, the Zeiss "Optimeter" which was described in October, 1924, MACHINERY. Errors smaller than 0.00001 inch, however, should be established by using an interferometer.

Changes in the length of gage-blocks occur with time, because the material from which the gage-blocks are made is hardly ever permanently stabilized. Thus gage-blocks usually continue to grow or shrink in size. While these changes are infinitely small, they cannot be neglected, as they may amount to several millionths of an inch within a few months, and in course of time reach a total error of 0.00001 inch, which would not conform to the standard of accuracy established for the best grade of precision gage-blocks.

In order to be independent of any comparative standards, which even if exempt from wear would still be subject to changes with time and require recalibration every few months, it is considered the best practice to determine the length of gage-blocks by means of light waves. The simplest application of the light wave principle is found in the use of optical flats by an ever-increasing number of inspectors and toolmakers, for testing the flatness, parallelism, etc., of highly finished surfaces. It may be well to explain here at some length the optical principle involved in light wave measurement.

How Light Waves Show Unevenness of a Surface

In Fig. 1, G represents the lower surface of an optical flat, S the upper surface of a gage-block, and h the thickness of air between them (greatly exaggerated). Light rays from a source P can reach a directly along the line Pa and be reflected in the direction b. Rays can also reach point a indirectly along the line $Pcda$, being reflected from surface S to a and then deflected toward e.

It is conceded that light travels in waves which we must imagine to consist alternately of a trough and a crest, an adjoining trough and crest constituting one full-length wave. Therefore, if two light rays correspond in vibration, that is, if the

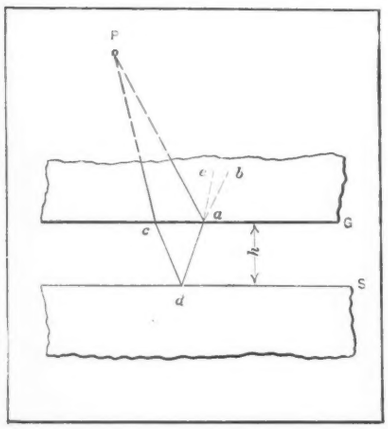


Fig. 1. How Bright and Dark Areas are Produced by Light Waves

trough of one wave coincides with the trough of the other, they will be in phase or augment each other, resulting in brightness.

This condition is illustrated at *A*, Fig. 7, where one wave is indicated by one type of dash and another wave, by a second type of dash. However, if the vibrations are opposed and interfere with each other, as indicated at *B*, they extinguish the light and produce darkness. For the sake of simplicity, it is assumed in this explanation that monochromatic light is used, that is, light of one color.

Referring again to Fig. 1, it can now be seen that point *a* in which the two rays *Pa* and *Pcda* meet can either be bright or dark, depending on whether the two rays upon arrival at *a* are in phase or in interference. This evidently is determined by the longer distance *Pcda*. If this distance is an even number of half-wave lengths, coincidence or brightness will result, but if it is an odd number of half-wave lengths, interference or darkness will result.

Supposing that surface *S* were a true plane perfectly parallel to *G*, then all the rays reflected by *G* and *S* would either be in phase or in interference; in other words, they would appear wholly bright or dark, respectively. In reality, no surface is a true plane, but rather a mass of high and low spots. Furthermore, the film of air is never quite parallel; in fact, for convenience in measuring, it is preferably wedge-shaped. Accordingly, there will be alternate areas of brightness and darkness on a piece under test, which are known as "interference fringes." These fringes may be straight or irregular bands or rings.

Each fringe produced on a surface represents a difference in the elevation of that surface, either plus or minus, equal to one-half a wave length. Thus, with respect to a surface under test it can be said that this elevation in different spots is expressed in planes or levels each one-half wave length apart. This condition is represented graphically in Figs. 3 and 4, in which *F* represents the lower surface of an optical flat. The greatly exaggerated film of air underneath it is divided into layers spaced evenly one-half wave lengths apart, as indicated by the light horizontal lines. When a gage-block *A* or *B*, Fig. 3, is placed within this film of air and observed through the optical flat, interference fringes will be seen on the surface of the block in the form of bands, as shown at *X*. However, if the upper surface of the gage-block were curved, the interference fringes would be in the form of rings, as shown at *X* and *Y*, Fig. 4.

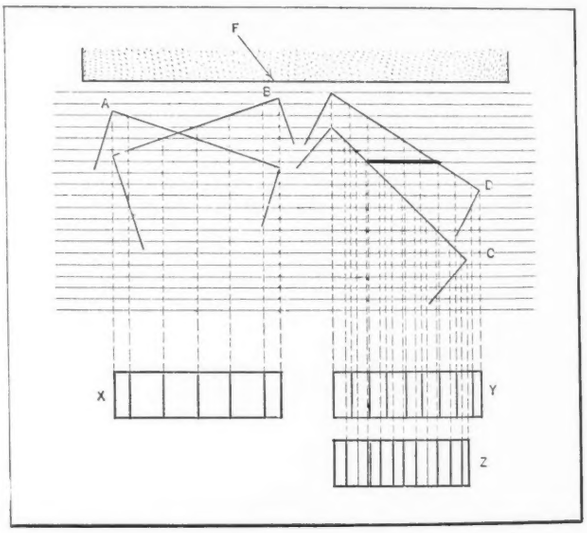


Fig. 3. Diagrams Explaining the Production of Interference Fringes on Flat Surfaces

By moving the gage-block closer to flat *F*, the fringes are made to travel in a direction opposite to the apex of the wedge of air between the gage-block and the flat. For instance, as the gage-block is moved from position *C* to position *D*, Fig. 3, the bands will change from the arrangement shown at *Z* to that illustrated at *Y*. If block *A*, Fig. 4, is raised toward the optical flat, the circular fringes will expand and indicate the surface to be convex, while if block *B* is raised, the fringes will contract and show the gage-block surface to be concave.

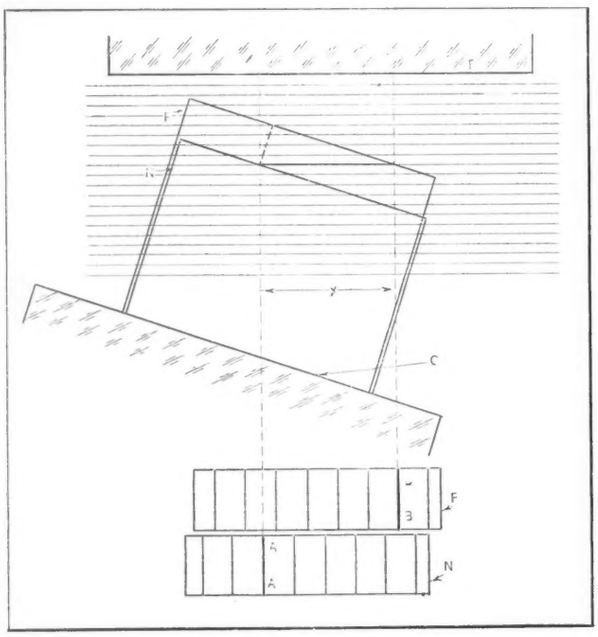


Fig. 2. Checking Gage-block Lengths by Comparative Method

Conditions Involved when Polychromic Light is Used

It has already been mentioned that, when monochromatic light is used, the interference fringes are dark areas separated by light areas. If daylight or some other source of polychromic light is used, however, the interference fringes will by a system of colored bands in which the elementary colors of the spectrum, red, yellow, green, blue, and violet, are readily discernible. There may also be present many other shades and hues caused by overlapping of the fringes. Each system or sequence of color

is of a definite order, but the colors exist in a given order only once, because the wave lengths differ according to the colors. When light produced from a helium tube is used, for instance, the lengths of light waves for the various colors of the spectrum are as follows: Red, 0.667 micron; yellow, 0.587 micron; green, 0.501 micron; blue-green, 0.492 micron; blue, 0.471 micron; and violet, 0.447 micron. (A micron equals one millionth of a meter or, 0.1 micron equals 0.000004 inch.)

Because the interference fringes do not occur twice in the same color sequence, it is possible to give a positive definition to every order or sequence of color fringes on which measurement by light waves is based. To illustrate this in its simplest form, let Fig. 2 represent the checking of two gage-blocks by the comparative method. It is assumed that the two blocks, of which *N* is the master and *P* the block to be tested, have been brought into intimate contact with plane *Q*. The lower surface of an optical flat is represented by *F*, and the wedge

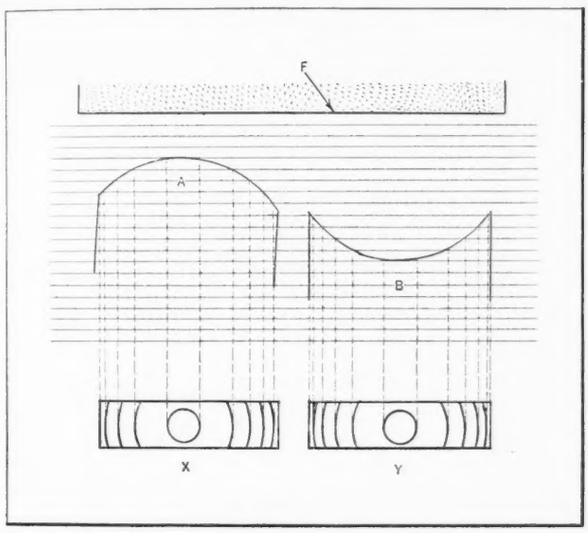


Fig. 4. Interference Fringes Produced by Concave and Convex Surfaces of Gage-blocks

of air beneath it is again shown as though made up of layers each one-half wave length apart.

Observation of the top surfaces of blocks *N* and *P* through *F* will show a system of interference bands, as illustrated at *N* and *P*, respectively, in the lower portion of the illustration. If monochromatic light were used, these bands would appear alike on both blocks, and it would not be possible to judge whether the two blocks were of even length or not. With polychromic light, however, the fringes are colored, and each system of fringes is of a different order, due to the different distances of the top surfaces of *N* and *P* from flat *F*.

It would now only be necessary to determine which line on *N*, as *A–A* for instance, is identical in color with a line on *P*, which we will assume to be *B–B*. If the sequence of colors both in reference to *A–A* and *B–B* also coincides, that is, if the bands to the right and left of *A–A* are the same in color as those to the right and left of *B–B*, respectively, it is definitely established that *B–B* is of the same order as *A–A*. Then it is only necessary to count the number of bands both lines are offset from each other, which, expressed in one-half wave lengths, represents the difference in length between blocks *N* and *P*. In Fig. 2 this offset distance is represented by *X*, and includes about 4 1/2 bands or 2 1/2 wave lengths.

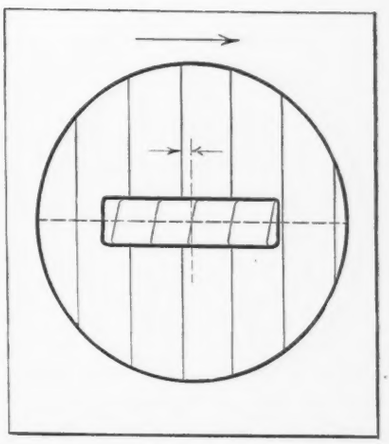


Fig. 5. Interference Fringes Produced on a Gage-block and its Base

In the foregoing example, we have still depended on a master block for checking the size of another block. Such a master is dispensed with when measuring absolutely by light waves. Then only the block to be tested is rung on plane *Q* and interference fringes are produced by the surface of the test block and by the surface of the plate on which it rests. The effect obtained is indicated in Fig. 5.

In principle, the method is the same as with the comparative test. However, there is the distinction that while in a comparative test the variation between the two blocks is usually known to be less than 0.00001 inch, in the absolute test the distance from plate *Q* to the top of the gage-block can be up to 1 inch or even more. From this it follows that no order of interference bands on the gage-block surface will ever correspond with the order of the bands on the base.

For this reason, as far as absolute measurement in light waves is concerned, the solution of another problem is involved, which has been accomplished in an ingenious manner in a new interferometer developed by Carl Zeiss, Jena, Germany, in collaboration with Dr. Kosters, director of the Berlin Bureau of Standards. This interferometer (see heading illustration) has been placed on the American market by the George Scherr Co., New York.

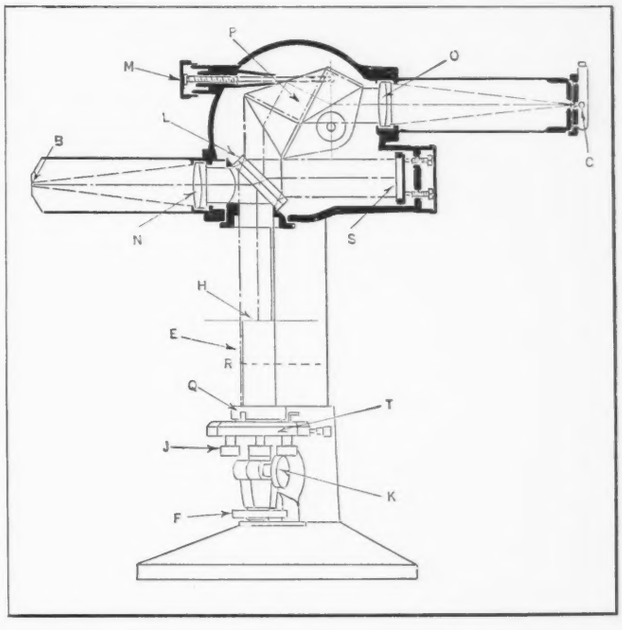


Fig. 6. Construction of the New Zeiss Interferometer

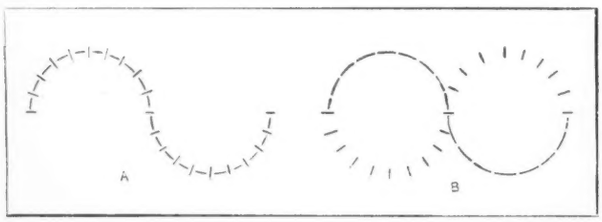


Fig. 7. Diagrams Representing the Action of Light Waves

Two features of this new interferometer are a swiveling prism for effecting spectral dispersion, and an adjustable virtual plane of reference about midway between the two surfaces of the gage-block. By means of the latter feature, only one-half the length of the gage-block to be measured is used for producing the two systems of interference bands. This feature is of considerable advantage in testing the larger blocks.

Fig. 6 shows a sectional view of the new interferometer. The source of light is an incandescent helium tube located directly in front of the horizontal slot *C*. After entering this slot, the light rays are collimated (made parallel) by lens *O*, and then passed through the dispersing prism *P* by which they are deflected at a fixed angle of 90 degrees to *L*, which consists of a semi-transparent silver film that is retained between two glass plates.

Here the ray is divided into two equal parts. One is reflected by the silver film toward mirror *S*, striking it perpendicularly and being, therefore, returned to and through the silver film *L* as well as lens *N* into ocular *B*. The other half ray passes through the silver film *L*, reaches the upper surface *H* of gage-block *E* and base surface *Q*. This ray is reflected back in itself by surfaces *H* and *Q* to the silver film *L*, and is finally passed through lens *N* into ocular *B*. In this manner, the two parts of the ray are reunited in the ocular in interference with each other.

By means of this optical system, plane *S* is reproduced in the ocular as though it were in plane *R*. Between this image *R*, on the one hand, and surfaces *Q* and *H*, on the other hand, when these surfaces are tilted slightly toward each other, interference fringes will occur. These interference fringes are formed by image *R* and surface *H* and by image *R* and surface *Q*. The amount of displacement of both systems of fringes against each other makes it possible for the length of gage-block *E* to be determined.

Plane *S* of the instrument is permanently fixed at right angles to the travel of rays *N–S*. With this condition, the diaphragm in ocular *B* and the image of *S* coincide when viewed through the ocular. Adjustment must be made by means of screws *J* to make sure that the rays directed downward are perpendicular to plane *Q*. In case of doubt as to which image belongs to plane *Q* and which to mirror *S*, an opaque plate may be interposed above base *Q* to make the distinction an easy one.

When the light is switched on, the optical system produces a spectrum in the focal plane of ocular *B*. By swiveling prism *P* with micrometer screw *M*, all colors of the spectrum can be successively brought into ocular *B*. The eye, when close to the ocular, will see images of surface *H* and mirror *S*, of which image *S* bears cross hair-lines. Provided the adjustment of the surface is approximately correct, interference fringes will now be observed. By adjusting set-screws *J*, these fringes can be brought into such position that the bands of base *Q* will be parallel with one of the hair-lines on the image *S*, as shown in Fig. 5, where the hair-lines are shown dotted. Furthermore, a band of the gage-block surface *H* can be set to coincide with the center of the hair-line cross by micrometer screw *F*, Fig. 6.

The hair-line cross now subdivides an interval between two bands of the baseplate *Q*. A fraction obtained by estimating the distance from the dotted hair-line to one of the bands on the base represents the amount by which the distance *HQ*—that is, the length of the gage-block—exceeds a whole number of one-half wave lengths. For instance, in Fig. 5 this fraction would be either approximately 1/5 or 4/5 of a band division, depending upon conditions to be explained.

At first glance, it is not clear which of the two fractions, 1/5 or 4/5, is the proper reading. This is ascertained by exerting a gentle pressure on the housing of the instrument. The result is a slight lowering of reference plane *R*, and consequently, a dislocation of the fringes seen in the ocular. Assuming that the fringes travel in the direction of the arrow at the top of Fig. 5, the reading should be taken to be 1/5 or 0.2. If the bands moved in the opposite direction, the reading would be 4/5 or 0.8.

The reading just explained is next obtained for all colors of the spectrum by revolving knob *M*, Fig. 6. The results for all colors enable a determination of the amount by which the gage-block differs from its nominal size.

Slide-rule Used in Conjunction with the Interferometer

It will be assumed that in checking a gage-block in the manner explained, the following readings were obtained for the different colors: Red, 0.8; yellow, 0.0; green, 0.3; blue-green, 0.4; blue, 0.5; and violet, 0.6. By simply approximating these readings on the slide-rule shown in Fig. 8, the amount that the gage-block varies from its nominal size can be read in hundredths of a micron. This slide-rule is graduated for one-half wave lengths

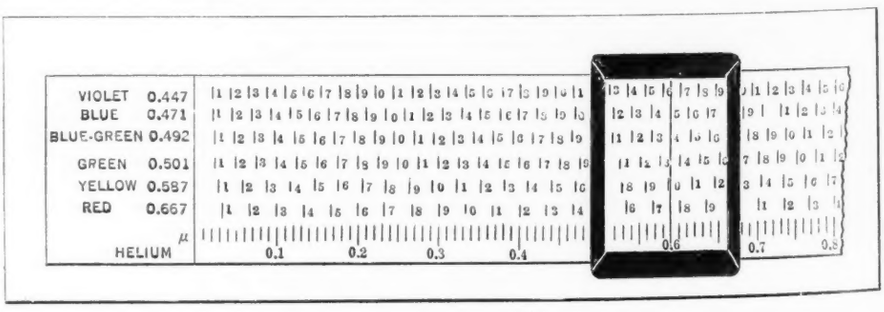


Fig. 8. Slide-rule Employed in Conjunction with the Zeiss Interferometer

of the various lights obtained by using a helium tube. Each division numbered 0, 1, 2, 3, 4, etc., represents tenths of one-half wave lengths of the corresponding color given at the left-hand end of the rule. At the bottom of the rule are graduations representing 0.01 micron.

In making a calculation on this rule, the hair-line of the slide must be positioned so as to simultaneously approximate each of the readings obtained for the different colors. As soon as approximately the proper order has been found, the reading in microns is obtained from the bottom scale. In Fig. 6 this reading is obviously 0.59 micron, which is the amount by which the gage-block varies from its nominal length. Whether this variation should be added to the nominal length of the gage-block or subtracted from it, is determined by means of simple calculations, the details of which would be of interest only to persons using the instrument.

The slide-rule has a range of three microns, and larger errors in the length of gage-blocks can only be determined after a certain computation has been made. A certain correction must also be calculated on account of changes in temperature, atmospheric pressure and moisture, as well as differences between the coefficient of expansion of steel (for the gage block) and quartz (for the baseplate). This correction is easily computed by means of a special logarithmic slide-rule furnished with the outfit.

The interferometer just described, while primarily intended for making absolute measurements, can readily be converted into a comparator by eliminating the spectral dispersion feature of prism *P*, Fig. 6. This is effected by simply changing the slot in front of the helium tube from horizontal to vertical. Then the individual images of the various colors cover each other, producing polychromic light, as required for comparative observation.

* * *

Of the ten original leaders in the automobile field in 1903, only one remains a leader in production. Of the ten leading firms in 1924, only two had been in the industry less than ten years. Most of the present leaders are not, strictly speaking, pioneers; they date back less than twenty years. But the successful units organized since 1908 have all been piloted by pioneer manufacturers. Most of the 1903 leaders who in later years either fell below tenth place, or else went out of business entirely, failed to sense certain changes that shortly took place in market demand. Their failure to sense market currents, rather than any lack of technical or manufacturing ability, accounts for their displacement as leaders.—R. C. Epstein, in *Harvard Business Review*.

The Basis of Fair Wages

In a series of three articles, the first of which will appear in August MACHINERY, Jacob D. Cox, Jr., president and general manager of the Cleveland Twist Drill Co., will deal exhaustively with a subject equally important to employers and employes. The three articles will cover, respectively, the economic basis of fair wages; prices, profits, and wages; and industrial prosperity and fair wages, the complete series forming a treatise on the subject of industrial economics as related to the wage problem. Many popular fallacies will be discussed, and the true significance of the relation of production to prices, wages, and the returns on capital invested will be explained. The articles are written in a simple, straightforward manner, that will hold the interest of the mechanical reader and provide an accurate conception of the whole subject of industrial economics.

BRAZING BY THE HYDROGEN PROCESS

By the use of atmospheres of protective gas in electric furnaces, steel parts used in the manufacture of complicated assemblies can be united by a strong alloy weld. This method, known as hydrogen brazing, involves the welding together of the parts to be joined by means of a copper flux. As the result of considerable development work by the General Electric Co., hydrogen brazing may now be applied successfully to many operations, with resulting simplification of method and reduction of over-all costs, owing to improvements in the equipment used. Electric furnaces of small size, utilizing protective atmospheres, have been used in laboratories for brazing by this method for some years. An early and important use was in the manufacture of steel shafts for golf clubs.

The theory of the process involves the reducing action of a hydrogenated atmosphere, which thoroughly cleans the surfaces to be joined, and the capillary attraction of the fluid copper causes it to diffuse quite generally over the surface and to be drawn into the most minute joints between the parts. The protective atmosphere is also essential during the cooling period, and for this reason, the usual type of furnace cannot be used.

A typical hydrogen brazing furnace consists of three "stages." Each stage is in the form of a platform. Covers which may be raised and lowered are provided for two of the stages. The work to be brazed is first assembled on one stage, copper wire or chips being placed adjacent to the joints to be united. The assembly is then placed in the heating chamber at a suitable temperature, and the next stage loaded. When the first assembly has been suitably heated over a predetermined period of time, it is withdrawn from the heating chamber and placed in a cooling chamber, the second assembly then automatically moving into the heating chamber.

Another application on which the protective gas envelope is used to advantage is in the bright annealing of steel in sheet or fabricated form, for nickel, monel, and certain other non-ferrous metals, to save the cost of annealing pots, handling, pickling, etc. In such work, a furnace of the continuous type is used, designed for larger output. The work is loaded on suitable trays arranged to be pushed through the furnace on a roller track. An elevator raises the trays into the furnace at the entrance end, and a similar elevator is used to remove them from the discharge end. A hydraulic cylinder pushes the work through the furnace. Heating takes place in only one portion of the furnace, the remainder being provided with a water jacket for cooling; thus the work is both heated and cooled in the protective gas atmosphere.

Giant Combination Milling, Boring and Drilling Machine

By S. WEIL, Chief Engineer, Schiess-Defries A. G., Dusseldorf, Germany

THE gigantic machine shown in the accompanying illustrations was built by Schiess-Defries A. G., Dusseldorf, Germany. It is specially intended for use in the manufacture of large size oil engines, for machining frames, cylinders, and similar large parts. The machine was designed with the idea of making it possible to machine these heavy parts completely at one setting, in order to save the time usually lost in transferring the casting from one machine to another and in resetting the work after each operation.

Machine Beds and Columns

This combination machine tool has two parallel three-way beds, each about 92 feet long by 8 feet wide, on which rest the columns or upright supports for the cross-rail on which the milling heads are mounted. These columns are traversed along the beds by means of steel racks fitted inside the bed plates. The racks have helical teeth which mesh with the feeding pinions. The feeding pinions are operated either by hand or power, slow variable feeds or quick power feeds being available. A heavy bracing girder connects the top ends of the large columns. This girder is fitted with vertical guides in which the cross-rail runs. An operating platform is provided for each of the two adjustable milling heads mounted on the cross-rail.

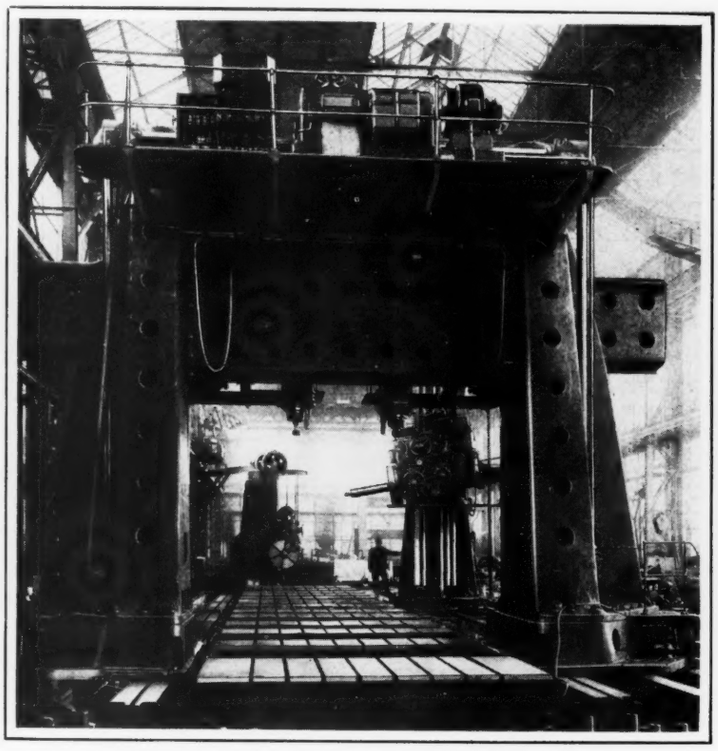


Fig. 1. Giant Combination Milling, Boring, and Drilling Machine

In addition to the cross-rail supporting columns, there is a separate column which can be placed on either of the bed plates, in front or in back of the other columns. This column, shown at the far side of the machine in Fig. 2, can be revolved on its vertical axis, and its boring slide is arranged to swivel horizontally, so that the main spindle has angular adjustment in two different planes.

A third adjustable column, fitted with a special device for boring large cylinders, is arranged on a separate bed bolted to the fore-end of the main beds and at right angles to them, as shown in Fig. 2.

The four tools mounted on columns as described have been designed not only for heavy work, but for light work as well, such as, for instance, the drilling of small holes, and milling with small cutters. For this purpose the tool-slides are fitted with a small secondary spindle, in addition to the heavy main spindle.

Capacity for Milling

The two milling heads on the cross-rail are independent of each other as regards both the spindle speeds and the amount of feed. The diameter of the steel main spindles is approximately 8 inches, and that of the secondary spindles, which are arranged beside them and run at twice their speed, is 3 inches. The main spindles are carried within massive octagonal shaped spindle boxes. These spindles have a travel of about 40 inches. The clear width between the side columns is about 14 feet 9 inches, and is the same as the maximum clear height above the bed of the machine.

The universal column is fitted with a spindle about 8 5/8 inches in diameter, which has a third bearing at the rear of the head. This spindle has a traverse movement of about 6 feet, and is fed in or out by a steep-pitch screw. Inside the main spindle is carried a high-speed spindle about 3 3/8 inches in diameter. The spindle slide is adjustable for height from 3 feet 3 3/8 inches to about 14 feet 9 inches over the floor plates.

Column Mounted on Cross-bed

The third column mentioned, which travels on a cross-bed about 28 feet 4 inches long, is fitted with a main spindle about 8 5/8 inches in diameter and an internal spindle about 3 3/8 inches in diameter. The faceplate of both the boring slide and the slide on the universal column is made axially movable for a distance of about 4 inches to assist in obtaining accurate settings.

Instead of a single large floor plate, such as is usual on machines of this kind, a number of small plates are provided, which are movable along the two beds. This construction facilitates locating work having bottom projections, which can extend into the space between two plates.

Six Motors are Employed for the Machine

Five direct-current variable-speed motors of the same type, each of 24 horsepower, with a speed range of from 460 to 1380 revolutions per minute, are employed. One of these motors is provided for each head on the cross-rail and each of the two separate columns, while the fifth motor, arranged on top of the bracing girder, serves to traverse the cross-member and its columns, and to raise and lower the cross-rail. All the motors are reversible and are controlled by means of push-buttons. A sixth motor, of 7 1/2 horsepower, mounted at the base of the universal column, supplies power for turning or pivoting this column. The columns and heads have a high-speed power-traversing speed of about 2 to 6 feet per minute.

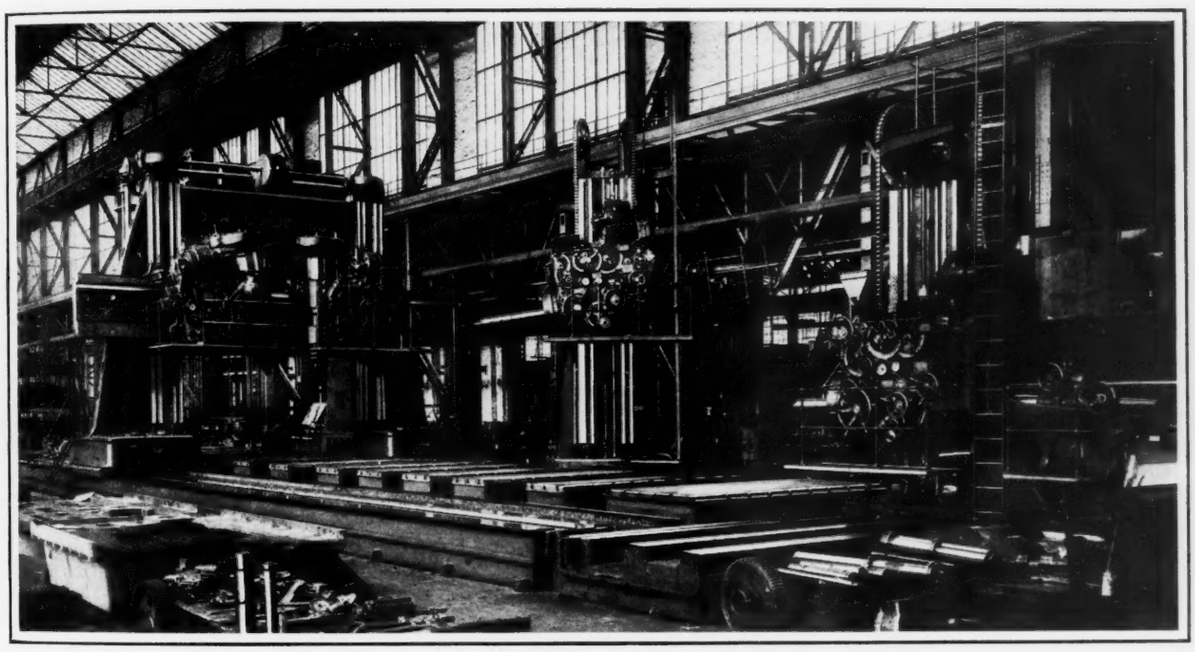


Fig. 2. Front View of Machine Shown in Fig. 1

The complete machine tool weighs about 500 tons. Automatic lubrication by oil-pressure pumps practically eliminates any danger of the main bearings becoming overheated. Interlocking controls make accidental engagement impossible. Brass plates containing operating data are located near the various handwheels and levers. From a platform fitted to each head and accessible by a ladder, the operator can easily reach all the controls, handwheels, and levers.

* * *

According to the National Automobile Chamber of Commerce, there are now over 4,000,000 people employed in some capacity in motor transportation in the United States. This includes workers in automobile and truck factories, parts factories, plants making tires, dealers, salesmen, garage and service station workers, and chauffeurs.

APPROACHING A PROSPECTIVE CUSTOMER

By THOMAS FISH, President, The Ready Tool Co., Bridgeport, Conn.

Below are a few suggestions that may prove helpful in approaching a prospective customer.

1. Be cheerful; your prospect may have troubles of his own.

2. Say that you have something new to show him; no one wants to hear about old things, but few would refuse to at least look at something new.

3. Be early; the other fellow may be late, and you will receive attention ahead of him.

4. Be brief with the purchasing agent. He has his duties, but they do not consist in looking over your samples. That is the duty of the tool supervisor.

5. If possible, get the name and title of the right man. Seeing someone else does not accomplish the results required.

6. Think of new methods of approach that would interest you if you were in the other man's position; this will help you more than anything else.

7. Decide on what specific service your goods can render in the customer's shop. If you cannot think of any, you are of no value to the prospect.

8. Do not become discouraged; success may be just around the corner.

9. You have not accomplished all that you should, if you haven't either obtained an order or gotten a requisition started.

10. Put yourself in the other man's place; this will give you a better angle to work from.

11. Do not be afraid of anyone; we are all human.

12. Size up the situation for future calls and requirements; this will eliminate lost time and enable concentration on good prospects.

13. Leave a good impression, for the sake of future business.

14. Leave something as a reason for a future call. It will prove of great help later.

Machining Covers for Centrifugal Pumps

By J. E. FENNO

THE tools described in the following were designed for machining the cast-iron volute covers shown in Fig. 1. The operations, with their corresponding tools, will be described in the order of their sequence. Before machining, the inlet and exhaust ports are sand-blasted to cut down all possible resistance to water passage.

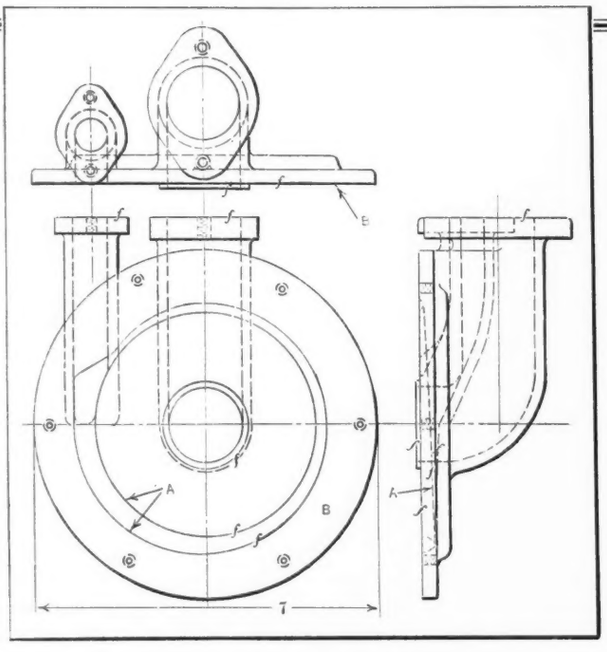


Fig. 1. Centrifugal Pump Volute Cover

The first machining operations are facing and turning the rabbet and forming the volute groove. The facing and turning of the rabbet is accomplished with standard tools in two stations of a turret lathe, while the operation of forming the groove *A*, Fig. 1, is done with a special tool-holding arrangement, as shown in Fig. 2. The work is held in three special chuck jaws two of which are similar to that indicated at *C*, the third being shown at *E*. The casting is held parallel to the face of the chuck by the three hexagonal posts *D*.

Because of the irregular nature of the groove, it was necessary to construct a special tool-holder and cam to guide the tool according to the eccentricity and depth of the groove. The base *J* of the special tool is centralized and bolted to a station of the turret. It is dovetailed so as to allow slides *M* and *T* to move in the line of the lathe centers, and at right angles to it on a horizontal plane. The slide *M* slides on block *J*, and this slide also carries the sliding member *T*. On slide *T* are mounted the rolls *P* and *O*, which turn freely on shoulder studs *S* and *R*. The rolls come in contact with the two cam surfaces of the ring cam *B*, which is fastened solidly to the chuck by the dowel set-screws *G*.

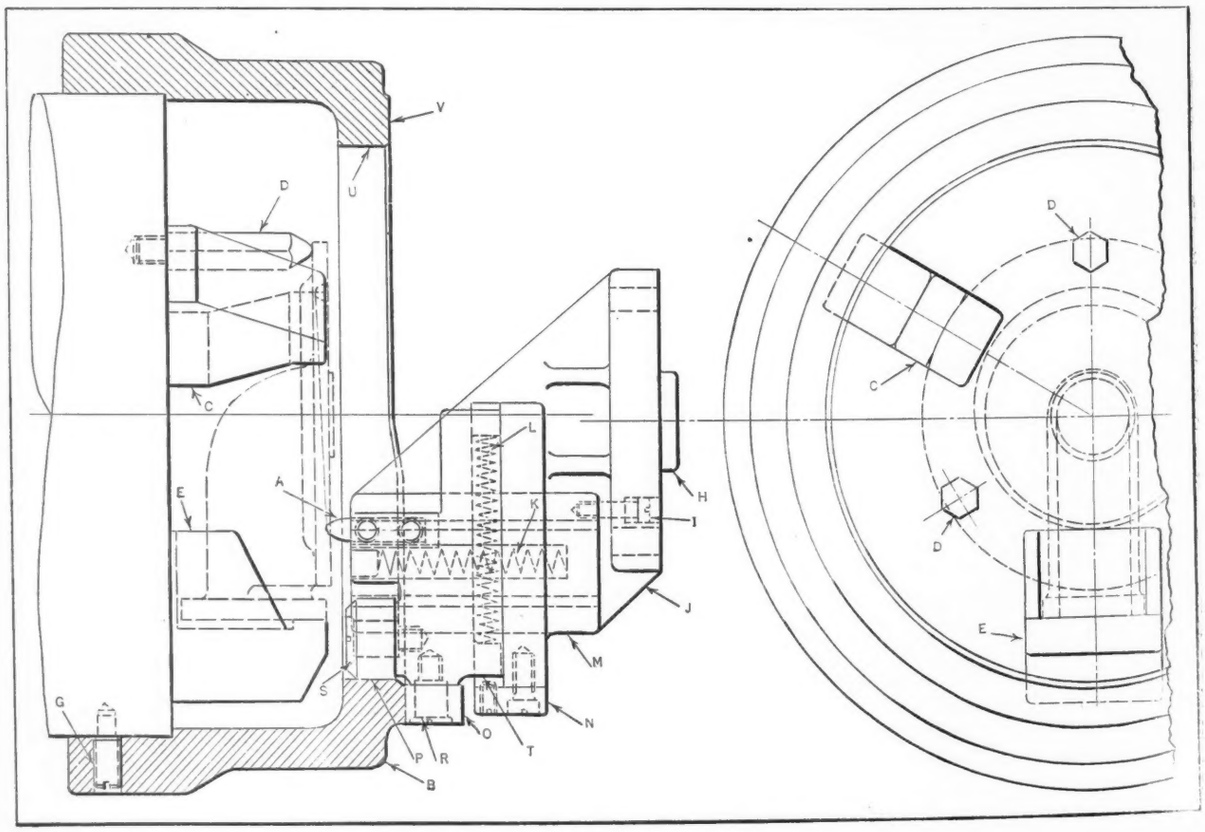


Fig. 2. Turret Tool-holder for Turning Volute

The springs *L* and *K* within slides *M* and *T* maintain contact between the rollers and the cam faces. The stop *N* and the fillister-head screw *I* limit the movement of the slides when the rolls are not in contact with the cam. The cutting tool *A* is fastened to slide *T* by two headless set-screws.

The operation is as follows: The volute grooving tool is fed forward until tool *A* comes close to the work. Then the cross-slide is moved toward the operator until roll *P* is in contact with the cam at its furthest distance from the center of the chuck. The cross-slide is fed an additional 1/8 inch to insure positive contact of the roll against the cam. As the surface *U* of the cam governs the eccentricity of the volute and the face *V* the depth of the cut, it is evident that for each revolution of the work, tool *A* will have produced the desired volute when the roll *O* has been fed in until contact has been established throughout the full revolution of the cam.

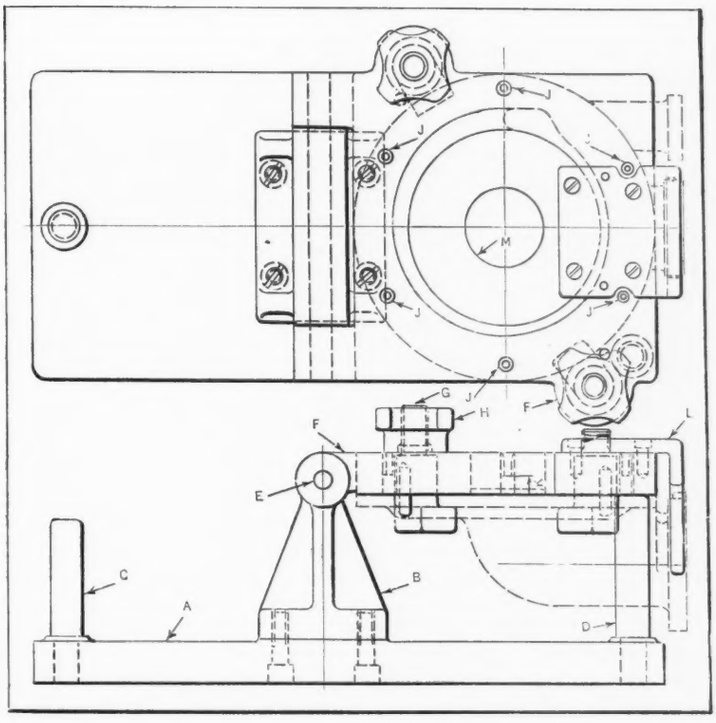


Fig. 3. Jig for Drilling and Tapping Volute Cover Flange

The next operation, that of drilling and tapping the large flange *B*, Fig. 1, is done in the jig shown in Fig. 3, which is strapped to the table of the machine. This jig consists primarily of the cast-iron base *A*, upon which is fastened the bracket *B* and the two supporting posts *C* and *D*. The pin *E* is a drive fit in bracket *B* and a running fit in both sides of the swinging plate *F*. The swinging plate carries two hook-bolts *G* with hand knob nuts *H*. The drill bushings *J* are a drive fit in the plate, and it will be noted that there is an extra long gap *K* between the end of the bushing and the work. The work is shown by dotted lines. This provision is made to permit the tap to run a sufficient distance through the work, as will be seen later. The locating angle *L* has a fork which straddles the large flange of the work.

The drilling and tapping is done in a multiple drilling machine, which is set up for two bolt circles, one for drilling and the other for tapping. The operation is performed as follows: With plate *F* resting on post *C*, a volute cover is centered in the bore *M*, the large elliptical flange located in the fork *L* and the hook-bolts tightened. Plate *F* is then swung over on post *D* and the six holes are drilled at one time. Next the plate is again swung to post *C* and the holes are tapped, the clearance *K* permitting the taps to pass entirely through the work. The hook-bolts are then loosened and the jig reloaded.

The next operation is that of milling the two elliptical flanges (see Fig. 1). Two covers are milled at one time. The set up is according to standard practice, and therefore is not shown here. The succeeding operation is drilling and tapping the two elliptical flanges. This is accomplished on a multiple-spindle drilling machine by means of the jig illustrated in Fig. 4. The base *A* of the jig is strapped to the machine table by the two lugs *B*.

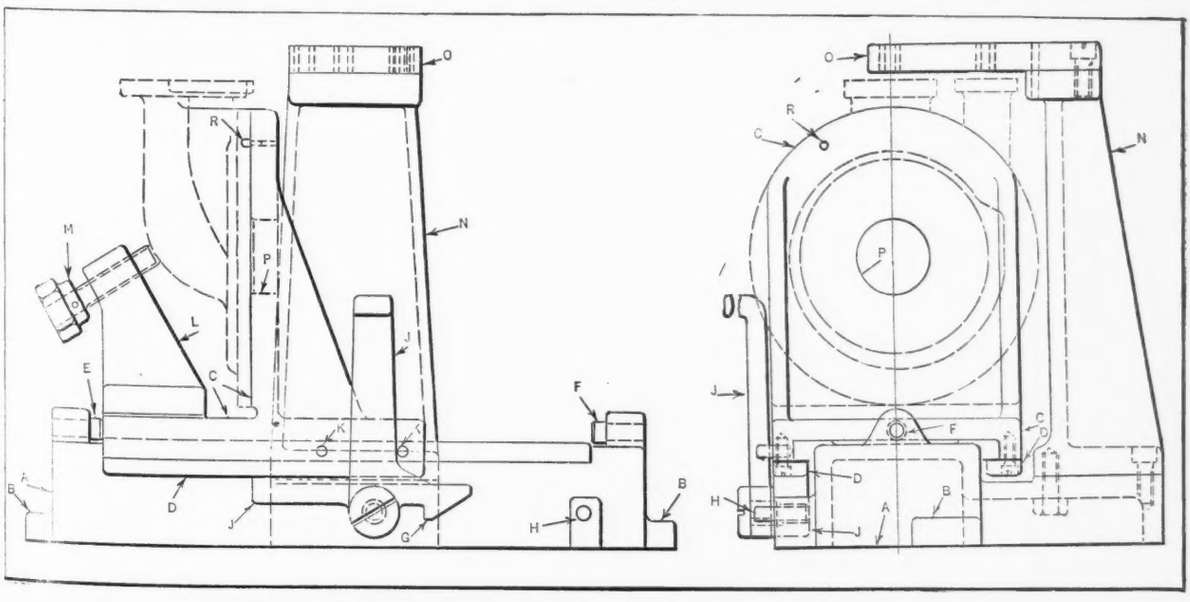


Fig. 4. Jig for Drilling and Tapping Small Flanges of Volute Covers

The carriage *C* slides on the base *A* and is held down by the gibs *D*. The carriage has two locations, governed by the two stops *E* and *F*, which are driven in the cast lugs on the base.

A positive locking of the carriage, required while drilling, is provided by the latch *G*, which hooks over the pin *H*, driven into a boss in the base. The latch swings on a shouldered screw threaded into the block *J*, which, in turn, is fastened by the gib to the slide *C*. The upper end of the latch is bent to form a hand-lever for engaging and releasing the lock. It is limited in its forward and backward movement by the pins *K*. The bracket *L* is fastened to the slide and carries the clamping screw *M*. In the right-hand view it will be seen that a bracket *N* is bolted to the base. At its upper end is fastened the drill bushing plate *O*.

The action of the jig in operation is as follows: The work (shown by dotted lines) is centralized in the bore *P* of the angle-plate projection of the slide and located by means of the pin *R* in one of the tapped holes. The screw *M* clamps the casting securely against the vertical angle of the slide. This is done while the slide is located as shown in the illustration. The slide is moved forward until it comes in contact with the stop *F* and the latch *G* drops over the pin *H*. The drills are then fed down through the work. After drilling, the latch *G* is released by pulling on lever *J*. Continued pulling on the lever will carry the slide back against the other stop-pin *E*, in position for tapping.

* * *

ENGINE OF "SPIRIT OF ST. LOUIS" STILL AT WORK

The Wright "Whirlwind" engine in Colonel Lindbergh's famous trans-Atlantic plane, the *Spirit of St. Louis*, recently completed its 485th hour in the air, during which time it had been serviced six times.

At the end of 85 hours, the engine cam follower was replaced.

At the end of 95 hours, one exhaust tappet roller pin was replaced, several bent push-rods were straightened, and rusty valve stems polished.

At the end of 355 hours, all valves were ground. Scraper ring broken while disassembling, and compression ring with broken step, were replaced. One-quarter inch of metal was cut from the threaded end of the gasoline pump relief valve needle, the slot was recut, and a battered cap replaced. Idler gear pin in fuel pump was polished, and a battered fitting replaced. Three burred compression rings were stoned, and ignition wires replaced.

At the end of 415 hours, obsolete exhaust valves were replaced with the latest type.

At the end of 471 hours, one leaking exhaust valve was reground.

At the end of 485 hours, two cracked spark plugs were replaced.

Effect of Concealing an Invention

If an inventor conceals his invention from the public for a long period of time after he has made and developed the invention, and if in the meantime, some other person makes the same invention, the original inventor may lose all claims to patent protection; in fact, a patent may be allowed to the person who was really the second to make the invention, but who was the first to give the invention to the public. Prior invention will not always secure patent rights to the original inventor, unless he can show that, after having made the invention, he has proceeded to develop it with the intention of obtaining a patent as soon as feasible. These and many other important facts of interest and value to designers and inventors will be dealt with in an article by H. L. Kauffman in the August number of MACHINERY.

EARLY HISTORY OF FORGING

In a talk recently given over the radio by Hugh Aikman, secretary of J. H. Williams & Co., Buffalo, N. Y., on "The Art of Forging," reference was made to the early history and methods used for producing different kinds of forgings. This talk was part of the series "Little Journeys into Great Industries" which has been given over the station WRNY.

Mr. Aikman pointed out that something like 5500 or 6000 years ago, Egyptian pictures show smiths at work. In one of these pictures, the furnace consists of what seems to be mainly a pile of charcoal. The fire is blown by workmen who apply their breath by blowing through long pipes of hollow cane. Other workmen are pounding metal in a manner indicating that the metal is either copper or gold. The hammers are semi-globular pieces of metal, probably copper, of a size to be grasped in the palm of the hand. Handles had not yet been invented. The anvil is apparently a block of wood with a flat metal top. Later the hammer was lengthened like the head of a mallet, made of a size to be gripped by the hand, but still without a handle.

A handle that fitted into the socket of the head is first noted in relics discovered in Nineveh in Babylonia about 900 B. C. This was a most valuable invention and multiplied by many times the force of the blow that could be struck, compared with that possible with the mallet head held in the hand.

From these crude beginnings, the art of forging gradually developed through improvements in furnaces, hammers, and anvils, but all operations still continued to be manual. At what date water-wheel power was introduced into forging is uncertain. It was used for working the bellows, possibly 500 years ago, but it was apparently not applied to hammering until about the year 1500. This application of power was a tremendous advance at that time. It was the machine superseding manual labor.

The design of these early so-called "tilt" hammers, however, was such that they were not very efficient. Although gradually increased in size and improved in design, they could forge pieces of but limited thickness, and as late as 1838—only ninety years ago—there was no hammer in England capable of forging the paddle-wheel shaft of the SS. *Great Britain* then building. It was to meet this need that James Nasmyth designed a hammer with the direct vertical action of a pile driver, but lifted by steam. This he patented, and in 1842 built a hammer rated at 3000 pounds. This marks the beginning of modern forging methods.

* * *

The annual production of buses in the United States is now about 10,000.

What Constitutes Invention?

By H. L. KAUFFMAN, Consulting Engineer, Denver, Colo.

TO be granted a patent by the United States Government, the applicant must disclose a new and useful invention. It is difficult to define an "invention," although the courts have occasionally stated what is not an invention. There are no positive rules (although there are previous judicial rulings on particular points) by which a "disclosure" can be tested to determine if it does disclose an invention; but there are certain general principles by which one may be governed in cases of this kind. These basic principles and some of the judicial rulings on important questions will be discussed in the present article. June MACHINERY contained an article in which the nature and subject of patents was considered.

The most basic principle followed in determining whether or not an invention has been made is whether, in view of all that has gone before (as disclosed in printed publications, in patents, or in prior use by the public), the inventor has used more than ordinary skill in creating the alleged invention. If he has, then invention resides in his disclosure; if he has not, then there is no invention. Another difficulty that is here encountered is due to the fact that no one has yet been able to measure "ordinary skill." It therefore becomes necessary to consider all the elements present in any disclosure, to apply both the general patent law and such technical knowledge as is available, and then to determine for each particular case whether or not invention is present.

The fact that an inventor has been granted a patent is considered sufficient evidence that the patentee is the original inventor of the device patented. To overcome the validity of a patent, therefore, evidence must be produced to the effect (1) that the device was previously made and reduced to practice in this country by another inventor; (2) that the device was previously known to and used by others in this country before invented by the patentee; or (3) that the device had been described in some printed publication prior to the supposed invention by the patentee. A foreign patent, to invalidate an American patent, must antedate the invention itself. It is not sufficient that it merely antedate the date on which the patent was applied for in the United States.

The Subject Matter Must be New

The subject matter of patents must be new and useful and, further, must be of such a character as to have called for the exercise of the inventive or creative faculties of the mind, as distinguished from the mere exercise of judgment and knowledge on the part of those skilled in the particular art. In addition, the idea must not have been abandoned by the inventor prior to his application for a patent nor have become public property by forfeiture under statutory provisions.

A patent is granted to inventors or discoverers of some new and useful art, machine, manufacture, or composition of matter; or some new and useful improvement thereof. This is true whether the invention claimed consists of an entire machine, an improvement of a machine, or a combination of several mechanical powers.

The alleged invention must not have been known to anyone before and, in this country, must be new, not merely to the patentee but to all the people in the United States at the time that the patentee makes his invention; not at the time that he files his application or secures his patent. Although prior knowledge by even a single person is sufficient to make it impossible for the applicant to be granted a patent (this constitutes anticipation), that knowledge must be of the complete operative invention, and not mere theory or speculation as to what might be done.

If an invention or discovery has either been patented or described in a printed publication of any foreign country, that invention cannot be patented in the United States. However, devices known and used in foreign countries, but not patented there nor described in a printed publication are patentable in the United States, provided the applicant has been given no notice of the use of that device by a particular party in that country.

The novelty of an invention may reside in:

1. The particular means used for accomplishing an old result.
2. The use of old means in a new way or in a new relation, whereby new functions are performed or new results are produced.
3. Changes of shape or form to produce new functions or results.
4. The arrangement or combination of old elements whereby an advantageous result is accomplished.

An invention residing in the use of old means in a new way is not rejected by the Patent Office, provided the new use is one that would not occur to one using the original thing. Changes of shape or form to produce new functions and results are patentable only when the change amounts to invention, mere novelty of form being insufficient.

What Does "Anticipation" Mean?

A patentee's claim to invention is "anticipated" when it appears that another made the invention before the date when the patentee made it. Knowledge of this phase of patent regulations is of utmost importance to the person of inventive genius, since thereby the inventor may save himself much wasted and misdirected effort. "Anticipation" may consist of prior patents or publications. If a patent is to be allowed, there must be a substantial difference in principle from all prior inventions, whether or not such prior inventions have been patented. Fur-

thermore, abandonment of prior invention does not prevent anticipation, although mere surmises of earlier students of the same subject do not anticipate. Only full and complete disclosure of the invention to the public, such as would enable those skilled in the art to make and use it, can be relied upon as an anticipation.

To amount to anticipation there must be identity in substance, not merely identity in form, and the two things must accomplish the same purpose by substantially the same means, operating in substantially the same way. Resemblance without identity is insufficient, although identity need extend no further than to the matter claimed. Mere superiority of the invention for which a patent is sought does not prevent anticipation. It might also be mentioned that it is of no consequence that the patentee made the invention by his own efforts and thought and in ignorance of the prior invention, since the fact of prior invention is the controlling influence in preventing the granting of the patent.

Prior Patents May "Anticipate" An Alleged Invention

If a patent disclosing the invention has been granted in this country or abroad before the claimant's date of invention, it is impossible for the Patent Office to grant a patent to the applicant. An impracticable prior device, not capable of performing the functions of a subsequently patented device that is practicable and useful, is not an anticipation. Furthermore, in order that a prior device may be cited to defeat a subsequent patent, the two must be for the same invention.

A foreign patent, to invalidate an American patent, must antedate the invention itself and not merely the date on which application was made for letters patent or the date on which the patent was issued by the United States. In this country, a foreign patent is considered to exist as a patent only as of the date when the invention was published or made accessible to the public in that country.

So-called "paper patents" (patents granted upon applications made without having first practically utilized the basic idea of the invention) may negative an otherwise patentable novelty, provided such paper patents sufficiently disclose the principles of the alleged invention, or provided the alleged objections can be obviated by mere mechanical skill. However, anticipatory matter that has never gone into practical use is generally narrowly construed by the Patent Examiner.

A prior patent, to invalidate a subsequent one, must describe the invention in such full, clear and exact terms as to enable one skilled in the art to construct and use it without the necessity of making experiments. The sufficiency of the description in the prior patent must be tested by the knowledge of persons skilled in the art as it existed at the date of the patent.

An important consideration for inventors to bear in mind is that it is immaterial whether or not a prior patent includes a claim to the subject matter, so long as the specification of the patent discloses the device with such clearness as to enable one skilled in the art to use it. The failure of the patentee to include the device among the claims of his own invention implies either that he abandoned it to the public or that he regarded it as well known. A patent is evidence of the state of the art at the time the drawings and specifications, upon which it was afterward granted, were made. It is well to remember that it is the state of the art and not the patent that constitutes anticipation.

Prior Publications may Anticipate an "Alleged" Invention

A prior publication is a printed book, newspaper, or document of public character disclosing the invention intended (so fully as to enable one skilled in the art to which that invention belongs or pertains, to construct or to use it) and actually employed for the purpose of conveying information to the public. Publication in a book of general circulation is sufficient, although mere business catalogues (intended for particular persons engaged in the trade) are not publications within the meaning of the law. Trade magazines found in public libraries, however, are considered as being "printed publications of general circulation."

A published drawing without a description is a publication of the invention, if the disclosure there made is sufficient to enable one skilled in the art to make and use the invention. So, too, a provisional specification published in England amounts to publication, as does also any copy of a foreign patent in the Patent Office or public library. A book containing the minutes of a company or an application for a patent is not a publication; neither is a description contained in a single copy of a book published in a foreign country, not entered in the list of books contained in a library.

The basic principle that determines whether or not an invention has been made is whether, in view of previous knowledge, as disclosed in printed publications, by patents, or by prior public use, the inventor has used more than ordinary skill in making his invention. The great difficulty encountered is to define what is meant by ordinary skill. As there is no measure for this, it becomes necessary in each particular case to consider all the elements present in an invention, to apply both the general practice of the patent law and such technical knowledge as is available, and then to determine for each particular case whether the development really constitutes an invention within the meaning of the law.

Prior Knowledge and Use of an Invention may Anticipate

As previously mentioned, anticipating knowledge must be of a completely operative invention, such as will enable those skilled in the art to make and to use the invention without further instructions. Such knowledge must be based upon the certainty of information derived from a practical demonstration and not upon mere theories or mental conception of how the thing can be done. Further, to constitute an anticipation, the device must be operative and in a form adapted and intended for immediate practical use. Ordinarily, an invention must have been tested and found satisfactory, although some devices are so simple that no actual device is necessary to demonstrate their success. Mere mechanical defects that could be corrected by the ordinary mechanic will not prevent anticipation.

It is important to note that unsuccessful, unperfected, and abandoned experiments do not constitute anticipating knowledge or use. Successful experiment lies in developing a perfected device, capable of practical use, embodied in distinct form and carried into operation as a complete thing. Although models or unpublished drawings or descriptions may completely disclose an invention, they do not anticipate. Illustrative drawings of conceived ideas do not constitute an invention and, unless they are followed up by an observance of the requirements of the patent laws, they can have no effect upon a subsequently granted patent to another.

When an accidental result has been accomplished by means that the operator does not recognize or understand, and if no knowledge of the results or of the method of employment is derived from the discovery by any one, then such prior accidental production of the same thing does not amount to invention. Courts have ruled, however, that to constitute anticipation of a later patent, it is enough that such a construction has been in well established use, regardless of whether it originated in design or by accident, and an invention will not be deemed accidental because all the advantages of that invention were not understood or because the new form or result had never before been contemplated. Mere discovery in an old combination of a new property, however beneficial, is not patentable. Inventions never made public and later forgotten do not anticipate. However, an invention that has merely been concealed by the inventor is not a lost art.

The fact that the various elements of a combination are old does not anticipate a claim to the combination, for the accomplishment of which it must be shown that the same or equivalent elements have been combined in substantially the same way to produce substantially the same results. Further, the fact that the same thing in form is old in a non-analogous art, where it is used to perform different functions, does not constitute an anticipation.

A prior publication in patent law is a description appearing in a printed book, newspaper, trade journal, or document of public character disclosing the intent of the invention so fully as to enable one skilled in the art to which the invention pertains, to construct or to use it. The publication must be intended for general circulation. Mere business catalogues intended for a limited number of persons engaged in the trade only, are not publications within the meaning of the law. Trade journals, however, are considered as printed publications of general circulation. It is very important to avoid publishing a description of an invention until the patent has been granted; complications are thereby avoided.

Evidence of Anticipation

A patent is prima facie evidence that the patentee was the original and first inventor of the device patented. Whoever denies the patentee's claim in this respect has the burden of proof upon him to establish the contrary. This presumption of originality, in the absence of the application for the patent, extends back only to the date of the patent, and, in no case, further back than to the time of filing the original application. Where the defendant has shown knowledge and use of the invention prior to the date of the patent or the date of filing for it, the burden of proving a still prior invention is thrown on the plaintiff.

To overcome the prima facie presumption of the validity of a patent, evidence as follows is admissible: (1) That the device was previously made and reduced to practice in this country by another; (2) that the device was previously known to and used by others here before it was invented by the patentee; and (3) that the device had been described in some printed publication prior to the supposed invention by the patentee.

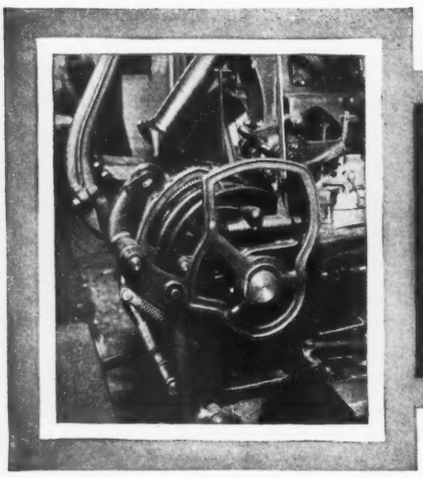
In rebuttal of evidence to show anticipation, evidence of an acknowledgment that the patentee was the original inventor is admissible; so, too, is testimony of persons whose business and experience have given them a knowledge of all improvements, such testimony being to the effect that no improvement like that covered by the patent in suit had previously come to their knowledge. In most cases, testimony also should be given concerning the construction and operation of the devices; and, likewise, testimony by persons who experimented to produce the subsequent invention, but failed to do so, and to whom the invention in question is known.

Mere applications for patents cannot be considered on the question of novelty, and to make the things described in applications available for evidence, there must be additional evidence that such things were actually constructed in working form. In order to defeat a patent on the ground of want of novelty, the proof of prior use or knowledge must be clear and sufficient to establish the fact beyond a reasonable doubt.

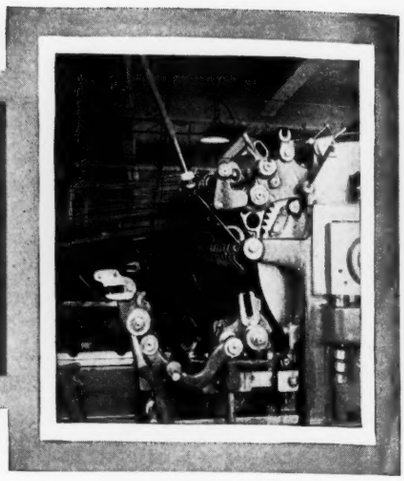
If a patent is to be granted, the invention must be capable of some beneficial use, the invention being deemed useful when it performs functions and secures the result intended, and its use is not contrary to public health or morals. It is worth noting that even slight utility will meet the demands of the patent law. The utility of a patent depends on the state of the art at the time of the claim made or the issuing of the patent. If the invention was useful when the patent was granted, then the patent is valid, and the fact that the invention has become useless by the discovery of other methods which dispense with it, gives no right to others to use the invention until after the patent has expired. Extensive use is evidence of utility and strongly attests to the merit of a patent. An infringement of an invention amounts to an admission of utility, since use implies utility.

* * *

According to information furnished by the Lincoln Electric Co., Cleveland, Ohio, the longest electric arc welded pipe line in the world has recently been completed between Lamkin and Hodge, La., a distance of forty-five miles. The pipe line is 7 inches in diameter and carries a pressure of from 600 to 1000 pounds per square inch. The line was built in five-mile stages, each stage being finished and tested under hydrostatic or gas pressure before work proceeded further. The joints were all made in two layers, and it is stated that in the tests only fourteen pin holes occurred in 11,000 joints.



Ingenious Mechanical Movements



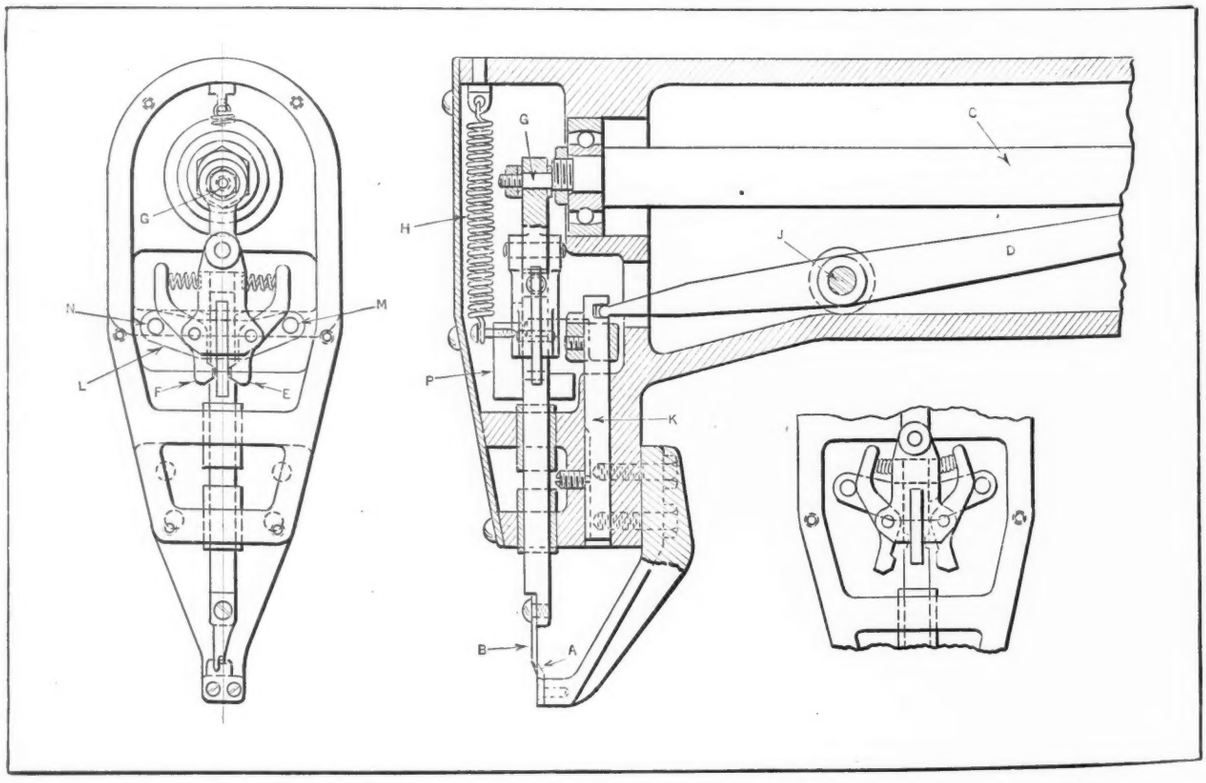
STOP FOR STENCIL-CUTTING MACHINE

By BERNARD J. WOLFE

A stencil-cutting machine used for cutting odd-shaped openings in stencils of various fibrous materials has a fixed knife *A* (see illustration) and an upper knife *B* which is given a rapid reciprocating motion. The stop mechanism to be described is so arranged that when a foot-lever is depressed, the cutter-slide is disconnected from the driving member, which allows the cutter-slide to stop instantly and always at the top of its stroke, thus permitting the work to be moved either away from the knife or from one opening to another.

The machine is driven by a constant-speed motor through a belt connecting with a pulley on the rear end of shaft *C*. The foot-lever which controls the action of the cutter-slide is pivoted in the machine base and connects with the rear end of lever *D*. The drive to the cutter-slide is through two hinged fingers *E* and *F* (see end view which shows cover plate removed). These clutch fingers are pivoted to a cross-head which is given a rapid reciprocating movement by crankpin *G*. The foot-lever normally is held in its upper position by a spring (not shown). When the foot-lever is depressed, clutch fingers *E* and *F* are forced out of engagement with angular notches in the cutter-slide, and as soon as the latter is released, it is pulled to the top of its stroke by spring *H*. (The spring *H* also takes up any lost motion that there might be in the reciprocating cross-head or connections). The cutter-slide remains in this upper position until the clutch fingers on the reciprocating cross-head are released so that they are again free to engage the angular notches.

The mechanism for controlling the disengagement and the engagement of the clutch fingers operates as follows: Lever *D* is pivoted at *J* so that its forward end moves upward as the foot-lever is depressed. The round end of lever *D* connects with and transmits this upward movement to bar *K* and



Mechanism for Quickly Stopping Cutter-slide of Stencil-cutting Machine, at the Top of its Stroke

to cross-arm L (see end view). Cross-arm L is secured to bar K by a set-screw, which allows the cross-arm to be adjusted up or down to accommodate any variation in any other part of the machine. This cross-arm has pins N and M, which act against the upper ends of the clutch fingers, compressing the springs shown and releasing the fingers, as indicated by the detail view in the lower right-hand corner of the illustration.

When the foot-lever is released, it is pulled upward by its spring, which, through the mechanism described, moves cross-arm L downward, and engages a tongue on the cutter-bar, forcing it down and thus allowing the springs to close the clutch fingers upon the cutter-bar so that they can engage the angular notches. A little clearance is provided in the bottom of each notch to allow for any wear on the tooth or the notch. The upper end of the cutter-bar fits into a hole in the cross-head. The cutter-bar also has a tongue P which serves as a guide for the upper end, the cross-head being slotted to receive this tongue, which also acts as a stop when the clutch fingers are released.

With this mechanism, starting and stopping is almost instantaneous, with the main drive shaft of the machine running at high speed. The knives may be formed to various curved shapes to facilitate cutting any fancy scroll work or small round holes. This machine, incidentally, is used in cutting leather gaskets, design stencils, and various other articles not required in large enough quantities to warrant the cost of a punch and die. The machine may also be used to advantage in trimming and cutting odd-shaped patterns and uneven edges of leather goods after the stitching operation. The upper knife has a sharp point or pilot on the lower end for piercing the work when starting the cut.

VARIABLE-SPEED FRICTION DRIVE

By MALCOLM P. DAVIS

The necessity for accurately adjusting or controlling the speeds of driven shafts has resulted in the development of a variety of variable-speed mechanisms. Among these is the friction-driven type of variable-speed mechanism. This type of variable-speed mechanism, shown in Fig. 1, has a maximum driving ratio of 4 to 1, and provides an accurate means of adjusting the speed of the driven shaft B within the required range of from 2 to 5 revolutions per minute when the driving shaft A revolves at a constant speed of 1 revolution per minute. Like most friction drives, this design is employed where the load is light.

The drive consists primarily of two spherical members C which engage the friction disk D of the driving shaft and the disk E secured to the driven shaft B. The variation in speed is obtained by rotating the spherical members C about the points F. When the spherical members are in the positions shown in Fig. 1, the driven shaft will be ro-

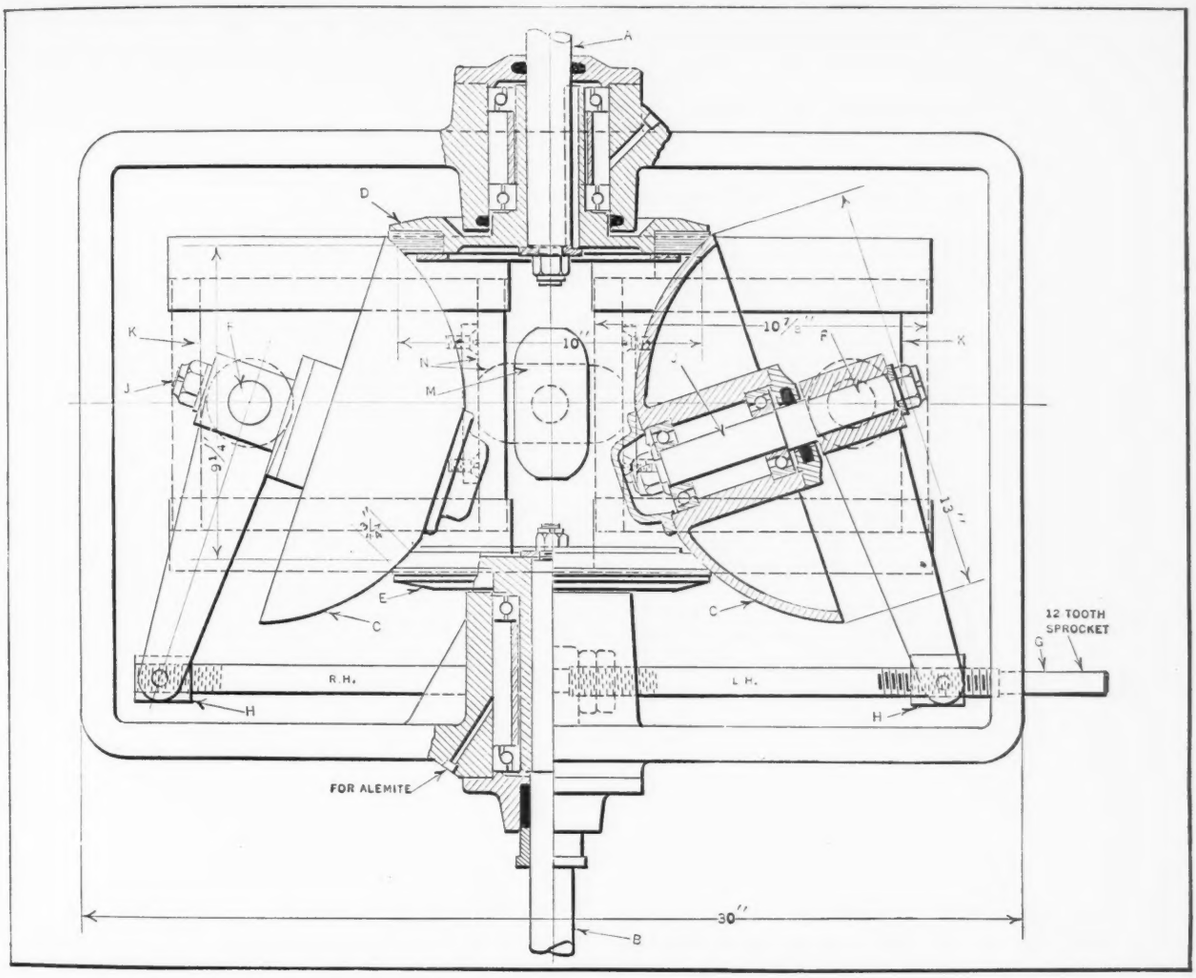


Fig. 1. Variable-speed Friction Drive Mechanism

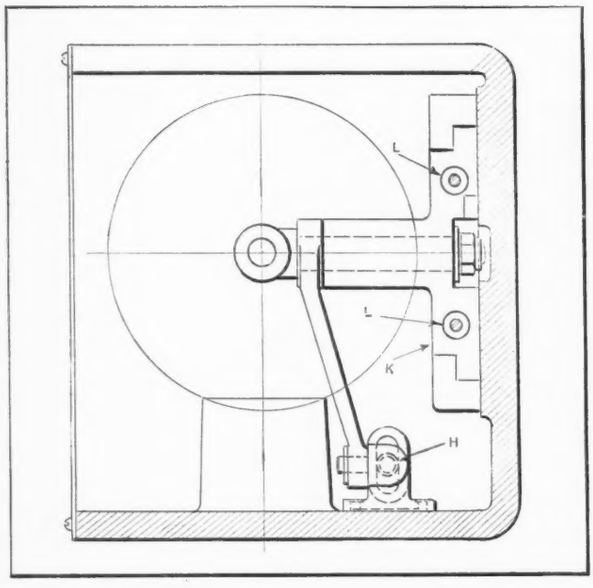


Fig. 2. Cross-section through Housing of Mechanism Shown in Fig. 1

tated at approximately its slowest speed, as the driving disk *D* makes contact with the spherical members at their outer edges, while the driven disk *E* makes contact near the centers of the members *C*, where the surface speed is comparatively low.

The operator adjusts the speed by rotating the shaft *G*, a sprocket and chain arrangement (not shown) being employed for this purpose. The right- and left-hand threads on shaft *G*, together with the nuts *H* attached to the arms of the bearing shafts *J*, provide means for accurately positioning the spherical members *C* to give the desired speed.

The members *C* are mounted on slides *K* (see Figs. 1 and 2). These slides are connected by springs *L*, Fig. 2, which serve to keep the friction members in driving contact with the disks *D* and *E*, Fig. 1. The friction drive can be disengaged at the will of the operator by means of a lever outside the housing, which controls the cam *M*. When the cam is turned, the slides *K* are forced apart, thus disengaging the friction driving members and causing the driven shaft *B* to stop. The dotted lines at *N* show the position of the cam and slides when the drive is stopped.

DOUBLE-TRACK CAM

By J. E. FENNO

A cam that provides the required motion and "dwells" for a slide on a special flat-wire forming machine is shown by the accompanying plan view. This cam is so designed that the follower *A* has a dwell at each end of its stroke. The cam has two concentric grooves *B* and *C*, and as it rotates, the roller on follower *A* is transferred alternately from one groove to the other by means of the switching levers *D* and *E*. The roll in the illustration is about to come into contact with lever *D*, which will swing around until the lug *F* engages pin *G*; then edge *D* will be flush with edge *H* and follower *A* will pass into groove *C*. The path thus formed to guide the roll into groove *C* is positive, as lever *D* is against stop *G* and lever *E* is against *J*.

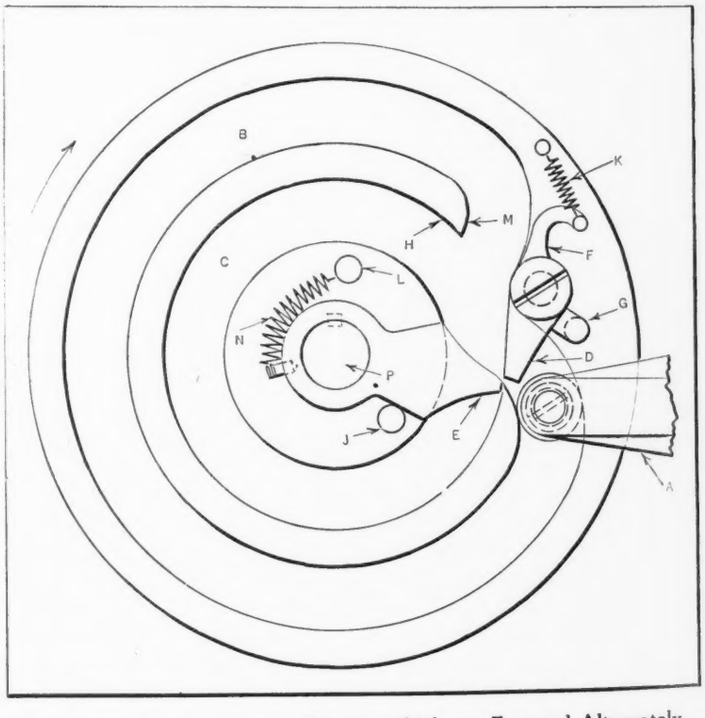
As soon as the roll passes the end of lever *D*, the latter snaps back to the position shown, through the action of spring *K*. The follower now dwells at one end of its stroke, as groove *C* is concentric. When the cam has revolved far enough to bring the roll into contact with lever *E*, the latter swings around until it strikes stop-pin *L*, and then the edge *E* is flush with end *M*. A path has now been formed which leads the roll into the outer groove *B*, after which lever *E* snaps back to the position shown, through the action of coil spring *N*. The cam rotation then continues until the roll is again in the position illustrated, when the cycle just described is repeated.

The follower is rigidly connected to a slide (not shown) which operates a mandrel for forming the stock. The cam receives its motion from shaft *P*. The required movement could have been obtained by the use of an ordinary cam, thus reducing the speed of shaft *P* one-half, but because of difficulties due to conflicting machine speeds, it was considered advisable to employ the special cam described.

* * *

ALUMINUM PAINT FOR OIL TANKS

As the result of investigations conducted by the Bureau of Standards in southwestern oil fields, an increasing number of oil-storage tanks and oil tank cars are being given an outer coat of aluminum paint. Paint of this description possesses high heat- and light-reflecting qualities. The experiments proved that the temperature of oil in tanks coated with aluminum paint was several degrees lower than the oil in tanks covered with other paint; besides, because of the lower temperature, the loss of highly volatile oils, through evaporation, was found to be less.



Cam having Two Concentric Grooves which are Engaged Alternately by a Roller on the Driven Slide

SPUR GEAR TOOTH FORM—1

TENTATIVE AMERICAN STANDARD

This standard tooth form has been approved by the American Engineering Standards Committee, the American Gear Manufacturers' Association, and the American Society of Mechanical Engineers. The standard covers the 14 1/2-degree composite system (full-depth tooth) and the 20-degree stub involute system. The basic rack of the composite system is shown in Fig. 1 of Data Sheet No. 134. The formulas for addendum, tooth depth, thickness, etc., are the same as those now in common use. The dedendum, however, is specified as "minimum," as is also the clearance.

A suitable working tolerance is to be considered in connection with all minimum recommendations, and clearance is recommended as minimum so as to allow perfect freedom for the necessary cutter clearance on any desired method of producing gears.

The central part of the basic rack for this composite system is a straight line which inclines 14 1/2 degrees with the vertical, and the upper and lower portions of the tooth are cycloidal curves. These curves are approximated (see Fig. 2) by arcs having a radius equal to 3.75 divided by the diametral pitch.

This composite standard represents, in scientific form, the basic rack of the interchangeable system of gearing used for many years in this country and abroad, and usually produced by disk cutters. This rack is not adding another, or new standard, to those now in use, as gears generated for this rack and produced by any system of good gear cutting, will interchange with each other and with gears made to the 14 1/2-degree system of disk cutters.

It is well known that a straight-sided unmodified basic rack will produce involute gearing, but unless the pressure angle is made much higher than the angles now in use, undercutting becomes a serious matter on pinions of low numbers of teeth. While this interference can be overcome for a single pair of gears by changing diameters and pressure angles, this composite system avoids interference by rounding off the tips or addendums of the teeth, and filling in the roots by modifying the involute curve so that it is continued at the tip and bottom as a cycloid curve, thereby strengthening the roots of the teeth and allowing the teeth to have tooth action beyond that which would be obtained with the pure involute. The line of action is therefore longer with the composite system than with the pure involute, the teeth being in action for a longer period.

The 14 1/2-degree composite tooth form was developed originally for use with the form-milling process, but can be made with equal facility on generating machines, such as hobbing machines, by making a hob of basic rack form. The relieving tool for the hob can be made to the form of the tooth of the basic rack, and used without correction.

The basic rack for the 20-degree stub involute tooth is a straight-line unmodified form.

MACHINERY'S Data Sheet No. 133, New Series, July, 1928

SPUR GEAR TOOTH FORM—2

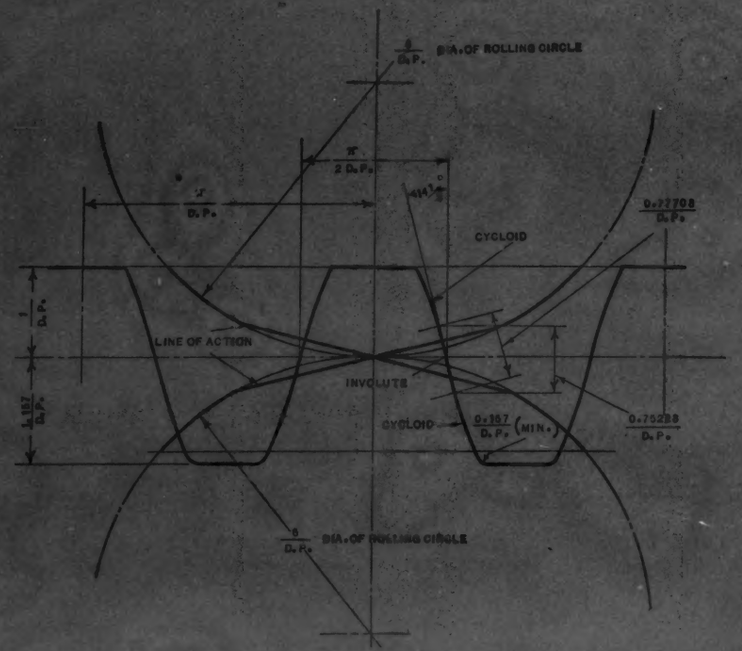


Fig. 1. Basic Rack for 14 1/2-degree Composite System (Full Depth Tooth)

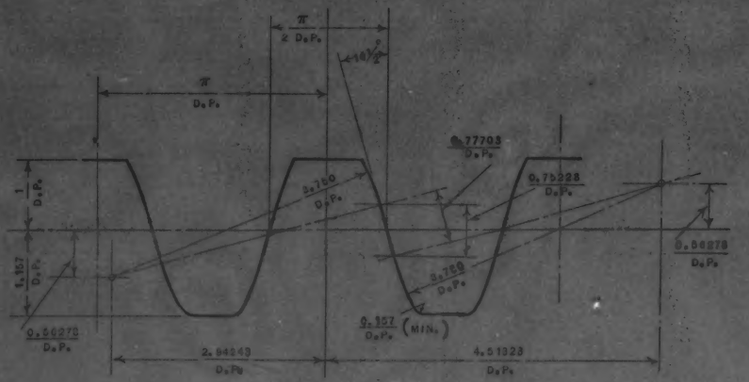


Fig. 2. Approximation to Basic Rack for 14 1/2-degree Composite System (Full Depth Tooth)

MACHINERY'S Data Sheet No. 134, New Series, July, 1928

Notes and Comment on Engineering Topics

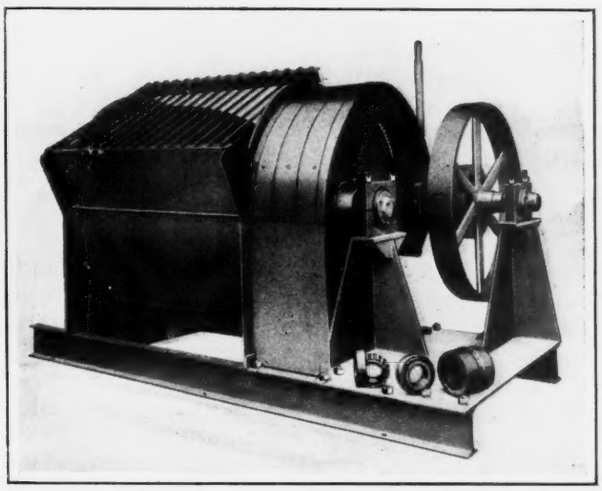
The growth of the demand for liquid oxygen since it was first made in this country in 1907 has been extremely rapid. There are now over 150 oxygen manufacturing plants in the United States, which, in conjunction with over 500 distributing stations, serve the industrial field with oxygen. The production is between two and three billion cubic feet annually. The cost of production since 1909 has been reduced from 4.7 to 1.1 cents per cubic foot.

An oil-electric switching locomotive was recently shipped from the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. to the Long Island Railroad, where it will be put into switching service. The locomotive, capable of producing 600 horsepower, weighs 85 tons and burns a very cheap grade of fuel oil. It is stated that what a steam engine will do on a ton of coal, this engine will do on 10 gallons of oil.

According to a table published by *L'Aeronautique* of the aerial flight records made up to December 31, 1927, Germany holds 20 records; the United States, 19; France, 14; Italy, 5; Switzerland, 4; Czechoslovakia, 3; Great Britain, 2; and Hungary, 1. Two of the records made in Switzerland should really be credited to Germany, as they were made with German equipment. It is also stated that the reason Great Britain holds only two records is due to the policy of the air ministry to discourage record-breaking performances, and not to any inferiority of British flying equipment. The speed record for seaplanes is about 7 per cent higher than that for land planes, while the altitude record for land planes is 480 feet higher than that for seaplanes.

Another interesting use for stellite has been found. The rapid erosion of impulse water-wheel nozzles in high-head plants has always been a troublesome problem, and maintenance costs run high. At one of the power plants in California, the water passes through a 7 1/8-inch nozzle with a velocity of 360 feet per second under an effective head of 2243 feet. The bronze or cast-steel nozzles have had a life of only from thirty-five to forty days, in spite of the fact that the water is clean and free from abrasive materials. By welding stellite wearing surfaces to the cast-steel nozzles, the effect of erosion by the water has been reduced to such an extent that no signs of it were found on the main water-wheel nozzles after two months of service, nor on the exciter-wheel nozzles after six months of operation.

Arc welding is applied extensively in the construction of a concrete mixer recently placed on the market by the Besser Mfg. Co., Alpena, Mich. Two standard I-beam sections form the main members of the base, and are tied together by channel-iron cross-braces which are rigidly welded to the main members. A flat cover plate on one end of the base serves as a partial support for the bearing pedestals. These pedestals are constructed of rolled plates joined by arc welding, as may be clearly seen in the illustration. Small pieces of plate are welded directly under the bearing points to serve as reinforcements.



A Machine Especially Designed to be Built by Arc Welding

The method of supporting the drum is also of interest, as well as the use of gusset plates for reinforcing the base against twisting. Another member of particular interest is the main driving gear, which is of all-welded construction. Its rim is made by rolling a flat bar into a ring and welding the ends. A square piece of plate with the corners rounded off serves as a web. The hub is welded to this web. It is pointed out that, in addition to the features of strength and lightness, this gear can be easily trued up and balanced. All of the welding done on the concrete mixer is performed by the "Stable Arc" process with equipment furnished by the Lincoln Electric Co., Cleveland, Ohio. It is an interesting example of the application of arc welding.

Minimizing distance is the great public service rendered by two types of railroad engineers—the one whose skill and judgment selected the best route, and the one whose efficiency wins from the locomotive the best performance. Cutting down the price of distance by engineering is an accomplishment that is of lasting benefit to the country. The political method of establishing favoring freight rates merely introduces an artificial factor which cannot affect the actual costs, for whatever the pronouncement of the rate-making body, the distance the locomotive actually travels is unaffected by it. I am tempted to comment that eloquence about equalizing industrial opportunity may convince legislatures and commissions, but it does not fool the locomotive.—*George Otis Smith*

Current Editorial Comment

In the Machine-building and Kindred Industries

TAPER SHANK STANDARDIZATION

The proposed standardization of tapers for cutting tools such as drills, reamers, counterbores and milling cutters is receiving marked attention. Both manufacturers and users of cutting tools are vitally interested in this movement, and it is of the greatest importance that the recommendations for standardization be made along the most practical lines.

At the meeting of the American Society of Mechanical Engineers in Pittsburgh, it was stated by the representative of a leading manufacturer of twist drills that 99 1/2 per cent of all tools now having taper shanks are provided with Morse tapers. This would indicate that in present practice there is actually a national standard taper although it has not been so designated by the final approval of the American Engineering Standards Committee. Apparently the Morse taper is not only a national standard through general acceptance and use, but is actually an international standard; because all over the world drills and similar tools are provided with Morse tapers.

Some objections to the Morse taper have been raised, but it is doubtful if any taper shank could be adopted that would meet all conditions without criticism. The important point is to standardize on a taper that has proved to give satisfactory results in practice under average conditions, and the adoption of which will cause the least confusion and expense to the makers and users of tools.

* * *

VALUABLE COMPARISONS

One of the large steamship companies is now building three liners identical in every respect, except that one is provided with reciprocating steam engines, one with steam turbines and one with Diesel engines. The purpose is to compare the economy of the three methods of drive under identical conditions, so that in future the most economical type of engine may be installed in all of the company's ships.

Similar methods of comparison might be used advantageously in production machine shops. Instead of discussing the merits of different machines, and comparing, on paper, one shop process with another, works managers might install one each of the rival machines that appear to have merit and compare the results obtained in actual production.

Such comparisons would indicate not only the productive capacity and accuracy of each machine, but also its "standing up" qualities. One, for example, may produce less per hour or day than another, but the former might require fewer repairs and less attention, so that the cost of its product would be less than that of the faster machine. Such important items as the repair cost and the time a machine may be out of production because of breakdowns, can be determined in no other way than by actual use. Another advantage in a comparison of this kind is that the machines are earning their way while the experiment is being conducted.

* * *

DELAY IN PLACING ORDERS INCREASES THE COST OF EQUIPMENT

Many buyers of shop equipment do not plan for their future needs of machinery and tools a sufficient time ahead, but delay placing their orders until the need is immediate; then they want deliveries in a hurry, and the machine tool builder and cutting tool manufacturer must try to meet the delivery date specified. Frequently, although his plant is by no means occupied to capacity, he must place part of his shop on an over-time basis and sometimes employ a night shift in order to deliver a certain machine on the stated date. As this delay in placing orders increases production costs, the machine tool buyer must ultimately pay this increase, because the builder must recover it or do the work at a loss.

The delay in placing orders also adds to the selling cost, because, instead of one or two visits of a salesman or engineer, the buyer frequently requires a number of visits and consultations before making a decision. The cost of all this must also be paid by the builder and added to the price of the equipment when sold.

Sometimes these delays are justifiable. It is necessary to be absolutely sure that new equipment is needed before orders are placed, but undue delay should be avoided. Many shops have planning departments to provide manufacturing schedules far ahead; similar planning ahead for the buying of machinery and tools would save money.

* * *

CORRECT THREAD MEASUREMENTS

In measuring screw threads, it is necessary to consider not only the tolerance on the pitch diameter, but also the tolerance on the lead of the thread; and these two tolerances must be considered together, if a good screw thread fit is expected. Many good mechanics measure only the pitch diameter, which they apparently consider all that is necessary; but the least important dimension of a screw thread really is the pitch diameter; and the most important, the lead. No matter how accurate the pitch diameter, this accuracy is valueless if the lead is incorrect.

This relation between the pitch diameter and lead has been frequently pointed out in articles published in the technical press and has been especially emphasized by the various committees that during the past few years have been engaged in screw thread standardization. It is therefore surprising that many mechanical men still overlook this factor in obtaining good fits between screws and nuts.

Training Men to Assume Responsibility

By General OTTO H. FALK, President, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

THE question has been raised: "Is it possible to train enough men within an organization, both for skilled shop work, and for executive positions in the shop, sales, and other departments?" On the basis of the experience of the Allis-Chalmers Mfg. Co. over a period of a great many years in training both regular apprentices and special apprentices of the college graduate class, and in filling important positions in the organization without going outside of the plant, I would say "Yes—unqualifiedly, yes."

The general policy of our company is to fill all positions, from shop foreman up, from the men now in our employ, instead of hiring outside men for these positions. The various training courses that are maintained by the Allis-Chalmers Mfg. Co. make it possible to pursue this policy, and to fill every position with thoroughly trained men, whose ability and characteristics have been definitely proved during their service with the company. We believe that every industrial organization should be a self-contained unit in this respect.

The whole purpose of the different apprentice and other training courses of our company, therefore, is to train a sufficient number of boys and young men to fill every supervisory position in the shop and all positions in the engineering and sales departments. By having adopted a training system of sufficiently broad scope, we have found it possible at the present time to achieve this. To do so, however, in a plant of the size of the Allis-Chalmers Mfg. Co., it becomes necessary at all times to maintain training courses for from 300 to 400 boys and young men. Of these, from forty to fifty are graduates of engineering schools, of whom about twenty to twenty-five are taken in for a two years' training course annually. We also train our own draftsmen, and at the present time have forty-three young men who are taking our draftsmen's training course. In addition, we have about 215 apprentices in the different departments in the shop.

There is also what is known as a "cooperative-student" course, through which it is possible for a young man who has completed high-school to obtain an engineering degree while serving an apprenticeship in the shop. This shop course is offered in connection with the Marquette University in Milwaukee.

It should be noted that one of the most important features in the success of all this training work is the departure from old-fashioned training methods in which the entire training was delegated to the foremen of the different departments. In the system in use in our shops, a number of instructors are employed who give their entire time to the training of apprentices and who have no other duties to perform. It is not fair to burden the foreman, who has productive duties to perform, with the instruction of apprentices, and it is not fair to the apprentice to leave him to pick up what instruction he may obtain by chance from fellow workmen. A successful apprentice system, at the present time, must be based on the idea of employing instructors who give their entire time to the apprentice training.

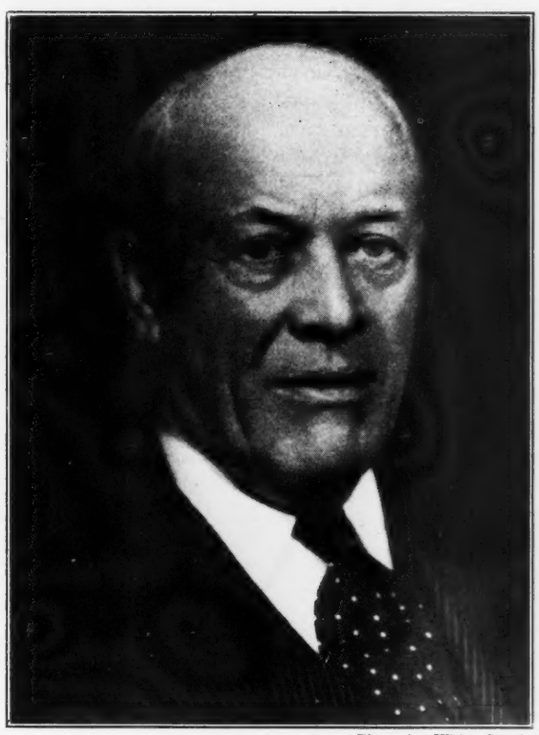


Photo by White Studios

General Otto H. Falk, President, Allis-Chalmers Mfg. Co.

Do the Young Men Remain with the Company After They are Trained?

The objection often made to a systematized apprentice training system, that the young man, when his training is completed, will leave the company to go to some other shop, has not been found to be based on facts in the case of the Allis-Chalmers Mfg. Co. Almost all the young men who complete both the regular apprentice course and the graduate student course stay with the company for several years, and many remain permanently. No better proof of this can be advanced than the fact that most of the managers of the company's district offices are men who have taken the graduate student course in the period of twenty-four years during which this course has been in operation. The same is true of the men in charge of the shops and the different shop departments.

Most of the foremen and assistant superintendents were trained as apprentices in the shop, and this is also true of the general works manager, the superintendent in charge of the foundry and pattern shop, and several of the other important shop executives. In the last ten years, with one excep-

tion, every executive position in the shop has been filled from men trained within the plant. The reason for the exception referred to was that the company acquired a new product from the outside, and a man experienced in its manufacture came with the company to continue in the same duties as he had filled with the previous concern.

Some time ago we took a census and learned that of the nineteen chief shop executive positions, seventeen were filled by men trained in our plant. Two positions only were filled by men trained elsewhere, but these men had been with the company for several years before being promoted to a supervisory position.

Is the Modern Apprentice System a Success?

It has often been said that at the present time it is not possible to attract a sufficient number of boys and young men to the machine shop and foundry trades to maintain a successful apprenticeship. The so-called white-collar jobs, it is stated, offer too great an attraction to the boys and it is possible for boys to go into production shops and earn so much more than the ordinary apprentice can earn immediately, during his training years, that recruits cannot be found for a regular apprentice course.

The experience of our company has proved these contentions to be erroneous. It has been found possible to maintain an apprentice course with 250 boys engaged in actual shop work over a period of many years—and not only has this been possible, but at the present time, the difficulty is, not to find apprentices willing to be trained to become skilled mechanics and draftsmen, but to provide room for all the boys who are looking for an opportunity to learn a trade. We now have a long waiting list of boys who are anxious to start as apprentices in our shops.

There is Only One Conclusion in Regard to Apprentice Systems

To summarize: Whenever the question is asked, "Is it possible to train and keep enough young men to fill all important positions within an organization from the ranks of those so trained?" there is but one answer. In fact, this is the only way in which an industrial undertaking can expect continuous success in business. It is just as important to keep a well trained personnel, ready to step into positions as they open through the progress and development of an enterprise, as it is to have equipment and material ready for the manufacture of the company's products, when orders are received.

The value of an apprentice system lies not only in the benefits accruing to the organization that provides the training, but in the greater opportunities offered to the individual, resulting in benefit both to the men and to the community. The progress and development of our industries demands that every industrial organization should pursue such a policy of training young men, so that each organization may become self-contained in this respect, to the greatest possible degree. There is no question as to whether it should be done, and no question as to whether it can be done. The question is merely for each industrial enterprise to decide to do it.

FASTENING MACHINES TO THE FLOOR

By ELTON STERRETT

The method of fastening down a machine outlined in the article "Method of Fastening Machine to Floor" that appeared in March MACHINERY on page 499 is admirable for what might be termed non-vibrating machines. The very property of malleability which permits calking the lead in a hole allows vibration to work a bolt head or lag screw loose, when used with a machine in which there is a vibratory, unbalanced, or reciprocating part. This was the condition by which I was confronted on a battery of automatic punch presses, which had been fastened to a concrete floor by the method outlined. The condition was corrected by the use of type metal, purchased from a newspaper office. Type metal ingredients are so proportioned that the metal has a low coefficient of expansion, and requires no calking. It is hard enough to resist the destructive effect of vibration, and is easy to handle in the molten state.

Removing the lead and pouring the type metal plugs on a number of presses without disturbing them was also a problem. After slacking off the hold-down bolt, a 1/2-inch hole was made in the concrete adjacent to the machine leg, drilled at an angle so as to reach the lead slug near its base. Into this hole a flame from an oxy-acetylene burner was directed, excess blast being used to remove the molten metal. Spattering was controlled by surrounding the machine leg and burner in a loose hood of asbestos cloth. The work progressed rapidly and the lead was completely removed. While the hole was still warm and dry from the heat of the burner, the type metal was poured in, allowed to cool, and the bolts tightened down. Presses fastened to the floor in this way four years ago are as tight today as the day the type metal was poured. This metal now entirely supplants the lead fastenings formerly used in our plant.

* * *

DIMENSIONING SHEET-METAL PARTS

By N. RICHARD

On page 659 of May MACHINERY a serious problem in sheet-metal detailing is dealt with. I think the proposed solution feasible and simple, except that it is so conventionalized that it would require constant vigilance on the part of the draftsman; and not being understandable to an outsider, might prove confusing. The same thing could be accomplished by varying the arrow-heads. For an outside dimension they could point outward, and for an inside dimension they could point inward. Their significance might not be clear to an outsider, but they would not confuse him.

Better yet would be to use the letters I.M. or O.M. at points where there could be confusion, the letters directly following the dimension figures and signifying inside measurement or outside measurement, as the case may be. Owing to their similarity to I.D. and O.D., universally accepted as indicating inside diameter and outside diameter, it is reasonable to assume that an outsider would catch their meaning. The simplicity of the interpretation would be well worth the extra effort of writing in the two letters.

Sectional Bakelite Mold for Radio Parts

By F. MARTINDELL

THE construction of molds for bakelite or other similar plastic compounds often calls for ingenuity on the part of the designer. This is especially true in cases where several parts are to be made in a single mold. The accurate matching of a number of separate impressions calls for skill of the highest order on the part of the toolmaker.

In Fig. 1 is shown a mold for the spider arms of a small loop aerial. These arms, as shown in Fig. 2, are grooved on each side to take the wires of the loop, which resembles the well-known spider-web coils. The sixteen plain arms and one supporting arm required for each loop are all made at one time in the mold, which has seventeen impressions. This mold is built up of tool-steel sections, assembled and held together by rivets.

Duplicate Sections Simplify Construction

The construction of the mold in sections changed the problem from one of sinking thirty-four half impressions, each with a number of troublesome sharp corners, to one of producing nine different parts for the mold proper, plus the enclosing ring, dowels, insert plates, and rivets.

The nine different parts for the mold are indicated by reference letters as follows: Part *A* is the outside strip, two of which are required; parts *B* and *D* are 1/4-inch strips containing teeth that form the wire grooves, of which sixteen are required; parts *C*, *E*, and *F*, are 1/2-inch strips that form the reinforcing rib for the supporting arm, of which eight, six, and two are required, respectively; part *G* is a 1/4-inch strip containing teeth for molding the reinforcing rib in the supporting arm, two of which are required; parts *H* and *I*—two of each are required—are 3/4-inch strips which form the reinforcing groove that finishes the right-hand side of the mold. This makes a total of forty pieces in the upper and lower members of the mold, which has a total of thirty-four half impressions.

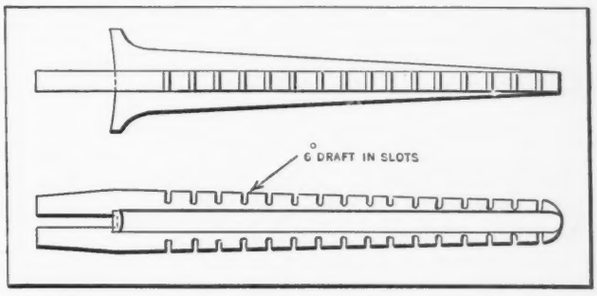


Fig. 2. One of Seventeen Parts Made in Mold Shown in Fig. 1

Machining the Mold Sections

The first step in making the mold was to rough-plane all the strips, removing about 1/16 inch from each side and leaving 0.015 inch for grinding. The pieces were all clamped together, and the steps in the ends cut on the planer. The dowel and rivet holes were then drilled and reamed in a special jig to insure accurate matching of the parts. The next step was to cut the teeth in the 1/4-inch strips *B*. This was done on a milling machine with a special cutter which formed one tooth and one half the space on each side of a tooth in one cut. For this operation, the pieces were aligned by dowels inserted in the holes, the milling vise being packed up at one end to allow for the taper of the ribs. Each group of eight pieces required two settings, owing to the opposite direction of the taper at the ends.

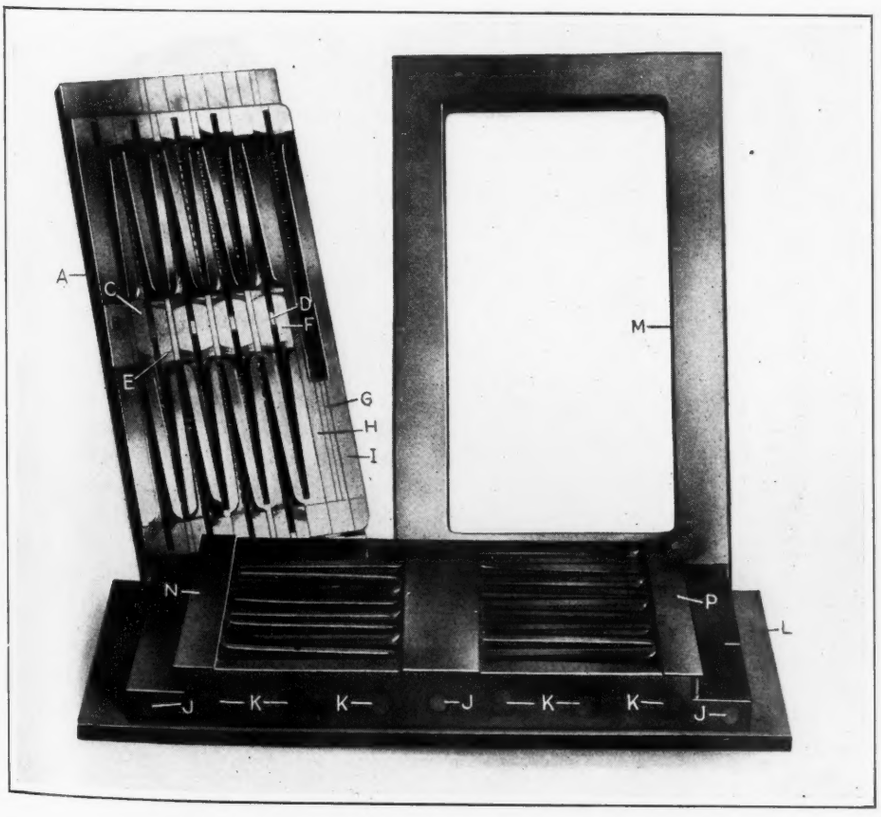


Fig. 1. Bakelite Mold for Spider Arms of Loop Aerial

The pieces forming the reinforcing ribs were then milled out in pairs, a small hemispherical cutter being used in the vertical mill, and the vise being packed up at one end to give the required taper. In this way, about 90 per cent of the work of sinking the die was done in two set-ups. The remaining work of finishing the impressions was done on the die-sinking machine and by hand, employing the usual methods. All parts of the mold were then hardened, after which they were ground in groups on a submarine type grinder, the maximum difference between any two similar pieces was only 0.0015 inch.

Assembling the Mold

The parts were polished with fine emery and oil before the final assembly, which was accomplished in the following manner: First the sections were arranged in their proper order, and the three 5/8-inch dowels *J*, which were a light press fit in the reamed holes, were put in position. The parts thus aligned were "set up" tight in a screw press. The rivets *K* were then heated red hot, inserted, and headed up. In cooling, these rivets pulled the sections firmly together. The size of the rivets was so calculated that the tension produced by shrinking was greater than the bursting force imposed on the mold by the molding operation. The top, bottom, ends, and sides of the mold were ground after assembling, and the bottom plate *L* of 1/2-inch steel fitted to the die. This plate was attached by means of screws to the outside sections, which were drilled and tapped before hardening.

The enclosing ring *M* was then fitted and hardened, a light grinding cut being necessary, as the straight sides of the ring bowed slightly after being hardened. Pieces *N* are the inserts which mold the slots in the ends of the ribs. The great saving in hand labor possible through the application of modern machining methods is exemplified by the unusual job described, which shows what can be done in a tool-room that makes the most of its facilities.

* * *

INVERTING CUTTING-OFF TOOLS

By CHARLES KUGLER

Referring to the comments on cutting-off tools in previous numbers of MACHINERY, I agree that inverting the tool-holder will stop chatter. When running a lathe backward, however, make sure that the chuck is securely fastened, because bad accidents have been caused by the lathe chuck coming off. Sometimes the tool can be inverted and placed on the opposite side of the work. Then the reversing of the spindle is not necessary. In some instances, it is possible to run the dead center against the work. This will also stop the chuck from coming off.

A Successful Trade School

For more than eighteen years, the Worcester Boys Trade School has been training boys for the industries. The methods employed in this school, which has been unusually successful in giving boys adequate training for their life work, are outlined in an article in August MACHINERY. The information given is detailed and yet concise, and gives a complete conception of how the school is conducted, its different departments, and the scope of the training. Those interested in adequate preparation for young men that are to enter the industries will find in this article a concise outline of what has been successfully achieved.

A TIME-STRETCHING CAMERA

Motion pictures are usually made and shown at the rate of sixteen exposures per second. The familiar slow-motion pictures are exposed at the rate of 160 per second and shown at the standard speed. While such pictures have been of some service in the scientific study of motion, their main use has been the amusement found in the grotesque effects they produce.

At the annual meeting of the Society of Automotive Engineers held in Detroit recently, C. Francis Jenkins, producer of the first photographs by radio, described the chronoteine camera with which photographs can be taken at a rate of 3000 exposures per second. Evidently it would be impossible for the film to be stopped and started rapidly enough for this, so the result is obtained by moving the film continuously past a shutter that remains open, the separate views being obtained by matched lenses mounted in a large rotating disk which pass between the shutter and the film—a most ingenious arrangement.

It is said that enough light is obtained so that the individual views have good photographic qualities. In fact, the exposures are longer than for slow-motion pictures with the standard type of camera, because no time is lost while the shutter is closed, and it is even possible to continue the exposure of one view until after the exposure of the next view is begun. One of the greatest difficulties in producing such a camera is the securing of forty-eight high-speed lenses matched accurately enough for the purpose, but this has been done so well that the pictures are not jumpy.

Pictures can be taken with this camera at various speeds. Several expedients are available for measuring the time, one of them involving a mirror mounted on the tuning fork to produce light flashes on the photographs at the rate of 500 per second. The standard stock super-speed negative film is used, and direct sunlight or its equivalent is required.

* * *

Regulations relating to commercial aerial traffic which provide for compulsory tests and ratings by the Department of Commerce for all motors designed for use in airplanes engaged in interstate commerce, has added another field of operation to the many activities of the Bureau of Standards, which Bureau has been assigned the work of testing new airplane motors. Although the testing of commercial airplane engines has only recently been undertaken by the Bureau of Standards, the automotive section of the Bureau has been studying the performance of aircraft engines for more than ten years. The endurance test to which the engines are submitted, in accordance with Army and Navy practice, consists of nine periods, totalling forty-five hours, at a rated speed and load, and one period of five hours, at 10 per cent overload.

Electric Drives for Machine Tools

By GORDON FOX, Electrical Engineer, and ARTHUR J. WHITCOMB, Assistant Electrical Engineer, Freyn Engineering Co., Chicago, Ill.

IN June MACHINERY, the general requirements connected with electric motor drives for machine tools were discussed in an article beginning on page 767. In the present number, motor drives for lathes, boring mills, and milling machines will be dealt with. Coming articles will cover other types of standard machine tools.

Motor Drives for Engine Lathes

The motor sizes required by different types of lathes are given in Tables 1 and 2. As has been previously stated, there are so many variables entering into the power required by machine tools that it is better to determine the power requirements by test than by calculation. The values given in the tables summarize the practice of machine tool builders and motor manufacturers supplying large numbers of motors to the machine tool industry. It will be noted that the proper capacity motor for a given size of machine depends largely upon the class of service. The motor should be large enough for the heaviest service the machine will be called upon to handle.

In connection with 12- to 16-inch geared-head engine lathes, it may be said that a motor smaller than 3 horsepower is not generally specified, due to the starting torque demanded by the lathe. The values given in Table 1 are for individual drive. For group drive, a horsepower of 40 per cent of the values given would be sufficient.

The values given in Table 2 are the motor capacities required for wheel lathes. It should be noted that a heavier load is taken in machining forged-steel wheels than is the case with chilled iron wheels.

Motor Control for Lathes

All lathes require some range of speed, the amount depending on whether the machine is used for a few simple operations or whether it is used for general work involving a wide range of diameters and materials. Cutting speeds as low as 20 feet per minute are used for rough cuts in gray iron. Most turning on this material is done at about 40 to 60 feet per minute, although some light finishing cuts may be taken at cutting speeds up to 80 feet per minute. Medium steel is generally turned at about 50 feet per minute, with finishing cuts up to 200 feet per minute. Hard steel is cut at somewhat lower speeds. Brass is ordinarily worked at 150 to 200 feet per minute, with finishing cuts up to 350 feet per minute. Hard bronze is cut at speeds of 50 feet per minute, similar to medium steel. If cooling water is employed, speeds can be increased about 40 per cent. Cooling solutions have little lubricating effect, and do not materially alter the unit power requirements.

It will be noted from the foregoing that the cutting speeds required for the variety of materials mentioned cover a range of about 20 to 1. The wide variety of diameters that a given lathe may handle

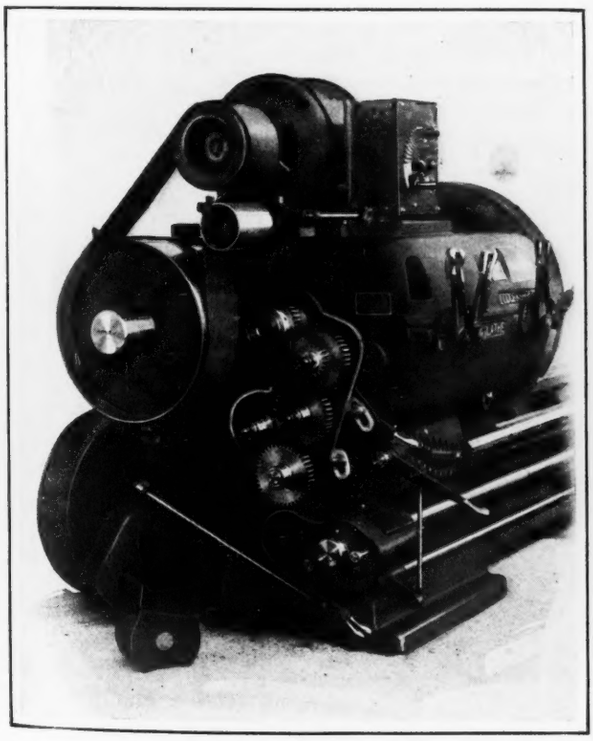


Fig. 1. Motor Mounted on the Head of a Lathe and Driving through a Belt

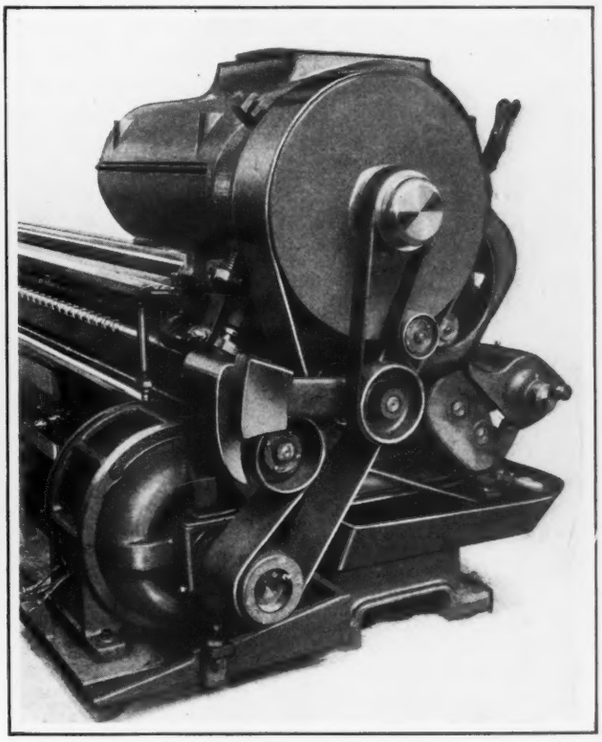


Fig. 2. Motor Mounted at the Rear of a Lathe and Driving through a Belt

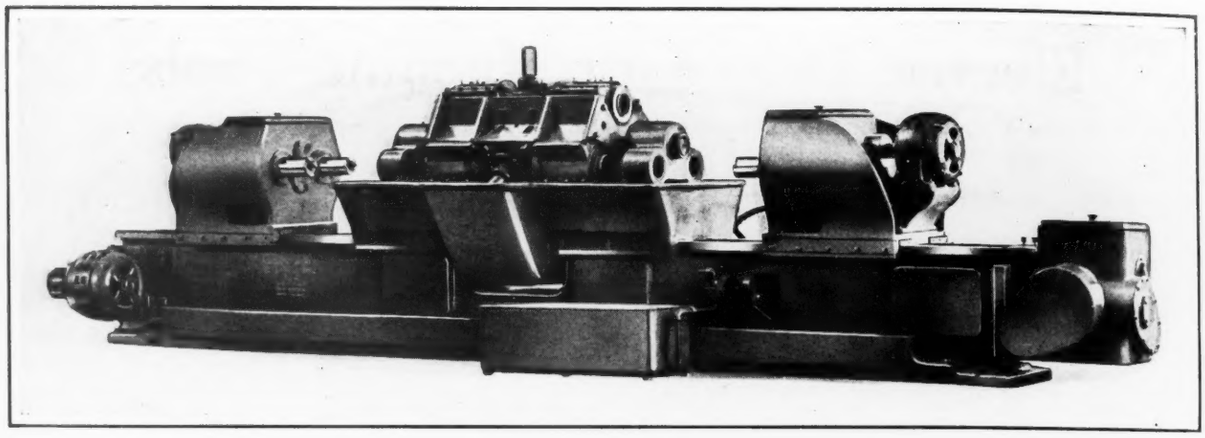


Fig. 3. Horizontal Boring Machine with Independent Motors Direct-connected to Each Head and with Separate Motor for Moving the Heads

further increases the range of speeds desired. A speed range of about 30 to 1 is commonly provided on general-purpose lathes. This can be obtained with an adjustable-speed motor through the use of one or more change-gears.

The use of a constant-speed motor drive, with gear-box for speed adjustment, is satisfactory for the smaller sizes, particularly when the same type of work is repeated for long periods, so that only occasional speed changes are necessary. Large engine lathes, wheel lathes, and roll lathes are not well adapted to the use of change-gears, and the adjustable-speed direct-current motor is particularly advantageous. When direct current is available, the adjustable-speed motor is usually to be preferred for lathe drive. Control is ordinarily reversing, and a dynamic brake may be employed for a quick stop if desired.

The location of the control stations deserves careful consideration. On an engine lathe of 8-foot bed or less, using magnetic control and an adjustable-speed motor, it will be found convenient to locate the push-button station on the headstock near the reverse clutch. The field rheostat should also be located at the same point. On a wheel lathe, two push-button stations are usually provided, one mounted on a stand back of the operator's position, and one at the back of the machine for use when adjusting the work. In this case, the field rheostat is mounted back of the operator's position. Some form of pendent switch, which can be manipulated by the operator without withdrawing his attention from the tool, may be preferable to the push-button station. Wheel lathes should be provided with a slow speed point for use on hard spots on the wheel. With a direct-current drive, this is attained by shunting the armature while maintaining full field. If alternating current is used, a wound-rotor induction motor may well be used, and secondary resistance inserted to obtain the temporary slow-down.

The control for the main drive of a wheel lathe is generally of a non-reversing magnetic type. A three-button station—start, stop, and slow—should be mounted on the front of the lathe convenient to the operator. The field rheostat should be similarly located. A wheel lathe may have a separate motor with a reversing drum control for the tailstock.

Lathes having a long bed are sometimes arranged so that the drum of the master controller is driven from a handle on the apron of the lathe, through a spline shaft and gears. This adds to the convenience of operation. Roll lathes may have two aprons. A spline shaft control, as described, for adjusting the speed from either apron is then desirable.

On large lathes, small motors are frequently provided for actuating the carriages and the tailstock. Single-speed motors are used for this purpose. If the traverse or tailstock motors run continuously, being connected to the traverse mechanism through a clutch or other mechanism, either a shunt-wound, direct-current, or a squirrel-cage induction motor may be used. In most cases, the motors run only when it is desired to traverse the carriage or tailstock. In such an event, a motor having a good starting torque should be used, either a series or compound wound, direct-current, or a high-torque squirrel-cage motor. The traverse and tailstock motors may be controlled by means

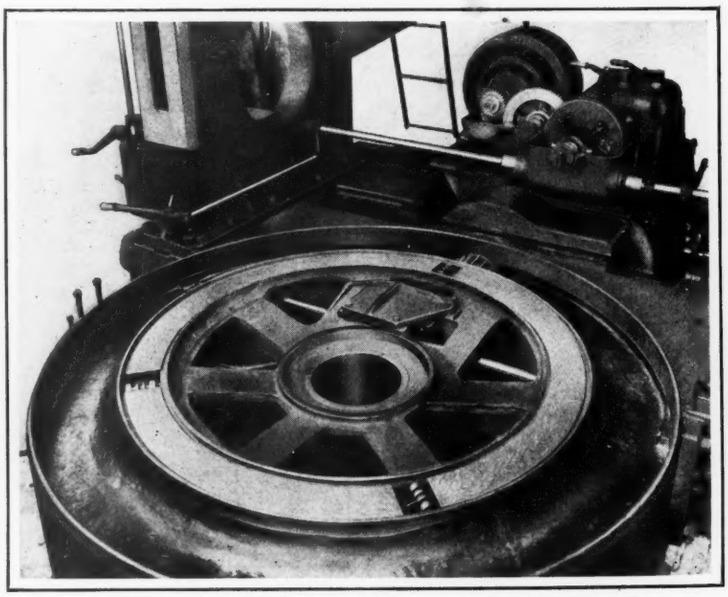


Fig. 4. Main Drive Motor and Table Drive of a Boring Mill

of a drum switch, although it will probably be found convenient to use automatic control to enable the push-buttons to be placed at convenient points.

Motor Drives for Boring Mills

A boring mill is fundamentally a vertical lathe, and as such uses the same type of electrical equipment. The main difference is that with the boring mill the operator's position is fixed rather than movable as with a lathe.

Table 1. Motors for Engine Lathes

Lathe Swing, Inches	Motor Capacity, Horsepower	
	Medium Service	Heavy Duty
12–16	1–2	2–3
18–20	3–5	5–7 1/2
22–24	5–7 1/2	7 1/2–10
26–28	10	10–15
30–36	15	20

Machinery

The size of motors usually required for boring mills is given in Table 3. With a boring mill, a variety of work is usually involved, requiring a range of speeds. An adjustable-speed, direct-current motor having a 3 to 1 or 4 to 1 range is the most advantageous installation. Small machines requiring not more than 15 to 20 horsepower may be controlled by a drum controller. On the larger sizes, a magnetic controller will be found preferable. A conveniently located, separately mounted field rheostat is used.

When only alternating-current service is available, a squirrel-cage motor may be used in conjunction with a gear-box for obtaining speed changes. The controller should be of the magnetic non-reversing type, with several push-button stations. One station should be placed on the front housing convenient to the operating position, another near the gear-shift levers for jogging the motor, while it may be found desirable to have a third located at the back upright.

In addition to the main driving motor, large boring mills may have a motor for elevating the cross-rail, two motors for traversing the rail heads, a motor for traversing the uprights of extension mills, and motors for clamping the cross-rail to the housings.

All these motors should be capable of developing a high starting torque. With the exception of the clamping motors, they may be compound-wound, direct-current, or high-torque, squirrel-cage motors. They should, however, be totally enclosed. Small drum controllers will be found satisfactory for their control, except where the convenience of push-button control is desired. The clamping motors must give maximum starting and stalling torque, and a series motor will be found preferable for either alternating- or direct-current service. A small drum reverse switch may be used for controlling them.

Table 2. Motors for Wheel Lathes

Size of Lathe, Inches	Motor Capacity, Horsepower
48	20–25
51–60	25–35
79–84	35
90	35–50

Machinery

Motor Drives for Milling Machines

Probably the largest class of milling machines is the column-and-knee type, used in the production of small pieces of various kinds. This type generally is equipped with a constant-speed motor, a clutch, and change-gears for obtaining various spindle speeds. The table is generally geared to the same motor. For constant-speed service, a shunt-wound motor with enclosed faceplate starter is satisfactory. For alternating-current service a squirrel-cage motor with a simple starter will suffice.

Milling machines utilize a number of cutters of various diameters, which require a range of speed adjustment. Speed control is particularly advantageous for gang work, since the speed of the mill is determined by the largest cutter, while the smallest cutter determines the rate of feed. An adjustable-speed motor with a 3 to 1 speed range, used in conjunction with one or two gear changes, will often be preferable to the simpler arrangement described in the preceding paragraph. This arrangement reduces the number of gears to a minimum, and gives a greater variety of spindle speeds.

Table 3. Motors for Boring Mills

Size of Boring Mill	Horsepower of Motor	
	Average Service	Heavy Duty
37 to 42 inches	5 to 7 1/2	7 1/2 to 10
50 inches	7 1/2	10
60 to 84 inches	7 1/2 to 10	10 to 15
7 to 9 feet	10 to 15	15 to 25
10 to 12 feet	10 to 15	25 to 35
14 to 16 feet	15 to 20	35 to 40
16 to 25 feet	20 to 25	40 to 50

Machinery

Small vertical milling machines use driving equipment similar to the column-and-knee type. On the larger machines, the spindle and the table may be driven by separate motors or the table may be geared to the spindle motor. The motor driving the spindle should be capable of starting the cutter while engaged with the work, and should be provided with means for reversal. When driven from direct current, a 3 to 1 or 4 to 1 shunt motor used in conjunction with not more than two gear changes and controlled by a dynamic braking type magnetic controller will be found satisfactory. When the only power available is alternating current, a wound-rotor induction motor or a high-torque squirrel-cage motor, or a squirrel-cage motor and friction clutch may be used. With the first two types, a magnetic reversing controller is to be preferred. With the squirrel-cage motor and friction clutch, a manually operated starter may be used.

Planer type milling machines must have means provided for driving the table and spindles, preferably at speeds which are independent of each other. Although this result can be obtained mechanically in conjunction with one constant-speed motor, it will be found preferable to apply adjustable-speed direct-current motors and automatic reversing control to all drives on the machine.

Some machines require a motor for elevating the cross-rail. For direct-current service, this motor should be a series- or compound-wound, totally enclosed, motor provided with a simple reversing controller having one step of armature resistance. For alternating-current service, a high-torque, squirrel-cage motor and drum reverse switch will be found satisfactory. The motor capacity for different sizes and types of milling machines is given in Table 4.

Automatic Screw Machines

The automatic screw machine is in reality a special form of lathe. The smaller machines may be driven by constant-speed motors or may utilize group drive. Inasmuch as the bed is so short, there

Table 4. Motors for Milling Machines

Vertical Slabbing Machines	
Width of Work, Inches	Horsepower of Motor
24	7 1/2
32 to 36	10
42	15

Vertical Milling Machines			
Table Feed, Inches	Gross Feed, Inches	Vertical Feed	Horse-power
22	12	18	3
28	12	18 1/2	5
34	15	20 1/2	7 1/2
42	15	19	15

Plain Milling Machines			
Table Feed, Inches	Gross Feed, Inches	Vertical Feed	Horse-power
22	8	19	3
28	10	19	5
34	14	20	10
42	14	20	15
50	14	21	15

Universal Milling Machines (Dividing-Head and Swivel Table)	
No. of Machines	Horsepower of Motor
1 and 1 1/2	1 to 2
2	3 to 5
3	5 to 7 1/2
4	7 1/2 to 10
5	10 to 15

Horizontal Slab Millers		
Width between Housings, Inches	Horsepower of Motor	
	Average Service	Heavy Duty
24	7 1/2 to 10	10 to 15
30	7 1/2 to 10	10 to 15
36	10 to 15	20 to 25
60	25	50 to 60
72	25	75

Machinery

is little advantage in having carriage control of the motor. For the larger machines, it is often well to use an adjustable-speed, direct-current motor.

* * *

According to the National Automobile Chamber of Commerce, the average life of an automobile at present is seven years.

SPACING DRILL JIG HOLES

By WILLIAM S. ROWELL

The writer read with interest the article entitled "Novel Drill Jig for Spacing Holes on Circle," on page 456 of February MACHINERY. The method for calculating the dimensions of the bushings, ring, and center plug, however, may be somewhat sim-

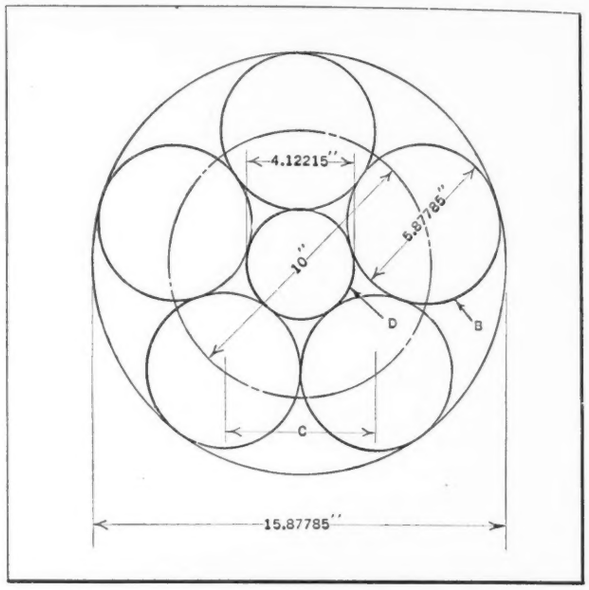


Diagram used in Solving Spacing Problem

plified by making use of the table of chords given on page 77 of the revised edition of MACHINERY'S HANDBOOK. The following procedure in finding the dimensions of the various parts for drilling five holes equally spaced on a 10-inch diameter circle will serve to illustrate the method.

In the table of chords, we find that the chord for dividing a 1-inch circle into five parts equals 0.587785 inch. Multiplying this dimension by 10 we obtain 5.87785, which equals the chordal distance *C* indicated in the accompanying diagram. This dimension is, of course, equal to the diameter of the spacing bushings *B*. The diameter of the center plug *D* equals 10 minus 5.87785 or 4.12215 inches. The bore diameter of the outer ring is equal to 10 plus 5.87785 or 15.87785 inches.

* * *

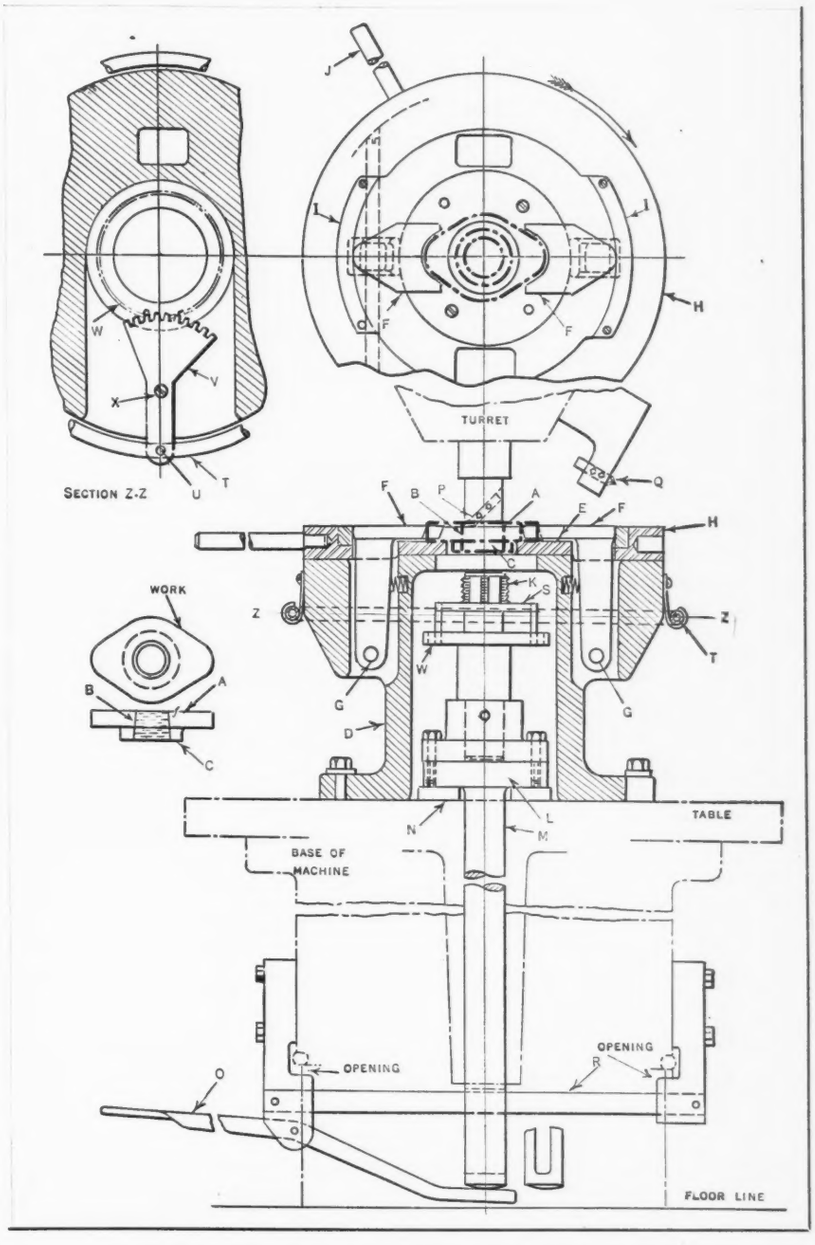
At a recent meeting of the Milwaukee Section of the Society of Automotive Engineers, James B. Fisher, of the Waukesha Motor Co., mentioned a number of novel engineering developments that he observed on a recent trip to Europe. Among these was a motor-boat built on a new principle discovered by a German engineer by observation of the salmon. Motion pictures of a salmon leaping up a waterfall failed to disclose any swimming movement of the fish, which seemed to be standing still in the water. How it supported itself in the falling water was a mystery, but the engineer decided it was done by taking water through the mouth and expelling it through the gills. So he built a boat having the propeller at the front and ports on the sides through which the water was expelled. It is claimed that this boat can be propelled at a given speed with one-seventh the power required when the propeller is at the rear.

Boring, Facing and Tapping Fixture

By B. J. STERN

THE fixture shown in the accompanying illustration is used for finishing the face *A* and tapping a pipe thread in the hole *B* of the cast-iron pipe flange shown in the plan and elevation views of the work, and by heavy dot-and-dash lines in the two views of the fixture. The flange is made in quantity lots, and was formerly finished in two operations, being first chucked in a lathe with boss *C* projecting outward for tapping the pipe thread at *B*. The tapped piece was then threaded on a stud held in a collet on the spindle of another lathe for finishing the face *A*. It will be noted that the pipe thread is tapped in the rough boss side at *C*, thus making it impossible to finish the face *A* and tap the hole at the same setting without using special equipment.

The base *D* of the new fixture is clamped to the rotary table of an old vertical turret lathe. The work is placed on the hardened and ground plate *E* with the boss *C* roughly centered in the hole in this plate. The two clamps *F*, located in cored holes in the base and pivoted on pins *G*, are so shaped that they grip the ends of the work and force it down on plate *E*. A heavy cam ring *H*, held on a finished shoulder on the top of base *D* by its own weight, has two hardened cam inserts *I* which move the clamps in and out when the cam ring *H* is moved around by means of the removable handle *J*. Holes are drilled at frequent intervals in the cam ring so that the removable handle can be easily applied, regardless of the position in which the fixture stops. When ring *H* is moved in the direction indicated by the arrow, the clamps *F* are caused to grip the work.



Fixture for Facing, Boring, and Tapping Pipe Flanges

In the cored hole of the base, is a collapsing pipe tap *K*, which is held vertically in an adapter plate secured in a flange *L* welded to the top of a nickel-steel bar *M*. Beneath flange *L* is a gum rubber shock-absorbing pad *N*. Bar *M* can be raised or lowered at the will of the operator by means of the treadle *O*, which extends through a slot in the machine base.

After placing a piece of work in position, handle *J* is employed to turn ring *H* in the direction indicated by the arrow a sufficient amount to cause cam-shoes *I* to force the clamps *F* to grip and hold the work in a central position. After the work has thus been properly clamped in place, the hole *B* is bored out, using the tool *P* held in the machine turret. The face *A* of the work is next finished by the tool *Q*, which is also held in the turret. The saddle feed of the machine is, of course, employed for taking the facing cut.

While the facing operation is being performed, the tap *K* is brought into operation. The operator accomplishes this by stepping on the foot-treadle *O*, which causes the collapsible tap to move upward into contact with the work, continued pressure causing the tap to enter the previously bored hole.

As soon as the tap is well started, pressure is removed from the treadle *O* and the tap allowed to thread its way upward. The tap is prevented from turning with the work by the bar *R*, which passes through a slot in bar *M*. The table of the machine is rotated in a clockwise direction, opposite to the usual direction, in order to tap the right-hand pipe thread.

When the plate *S* on the tap strikes the bottom of plate *E*, the tap is collapsed by the regular means employed for tools of this kind. When collapsed, the tap drops out of the threaded hole, falling back into its original position, the shock of its fall being absorbed by the rubber pad *N*. The facing and threading operations are completed simultaneously. The machine saddle is then run back to a stop, which locates the turret in the proper position for boring the hole in the next piece of work. Cored holes in the base *D* provide for the removal of chips.

The collapsed tap is set for the next threading operation by turning the ring *T*, which surrounds the fixture base. This ring is made of piping and is connected by a stud *U* with the outer end of a sector gear *V*, as shown in the view in the upper left-hand corner of the illustration. The sector gear meshes with the gear *W* on the tap body, and is pivoted on the shoulder screw *X*. The sector gear is of sufficient width to permit it to remain in mesh with the teeth of gear *W* at all times. When rotation of the fixture is stopped to permit replacing the work, the operator, by pulling the ring *T* around in its bearing straps, causes sector gear *V* to turn gear *W* which, in turn, resets the collapsed tap. The production rate obtained with the fixture described is forty flanges per hour, as compared with twenty per hour by the old method.

* * *

NEW TYPE OF WIND MOTOR

A novel type of wind motor has been erected in Southern California that is claimed to generate electric current whenever the wind is blowing at a rate of 4 miles an hour or more. The generator consists of an immense wind tunnel, in the center of which is placed a shaft carrying a series of propellers. By the aid of a huge funnel at one end, the wind is concentrated on the propeller blades. The entire structure is mounted on a circular track-base, so that it can be swung easily at any time to take care of changing directions of the wind. Electric controls automatically keep the large funnel square in the face of the wind. It is stated that the motor already built is capable of developing 200 horsepower in a heavy wind. The promoters claim to be constructing a much larger wind motor, capable of producing 1400 horsepower.

It is believed that if a number of these wind power generators were placed in different parts of a given district and the current pooled, there would always be an ample current supply, even if one or more generators were idle because of lack of wind. By having, for example, a dozen or more wind power generators within a radius of 50 or 100 miles, enough of them, the promoters believe, would at all times be in service to assure a continual supply of electricity. The operating costs would be very low, because the plant would require very little attention.

CHAMFERING AUTOMOBILE MAIN BEARING CAPS

One thousand main bearing caps are chamfered at both ends per hour at the Racine, Wis., plant of the Nash Motors Co., by employing the simple fixture shown in the accompanying illustration. This fixture is mounted on the table of a hand milling machine, and is provided with a hardened plate *A* which is rounded at the sides to fit the finished circular bearing surface of the cap. Plate *A* serves to guide the caps past two angular milling cutters as the operator pushes the caps along the plate. The cutters are spaced the proper distance apart on the spindle of the machine. A motor drive has been provided for the spindle. The caps are iron castings and are given 1/32-inch chamfers.

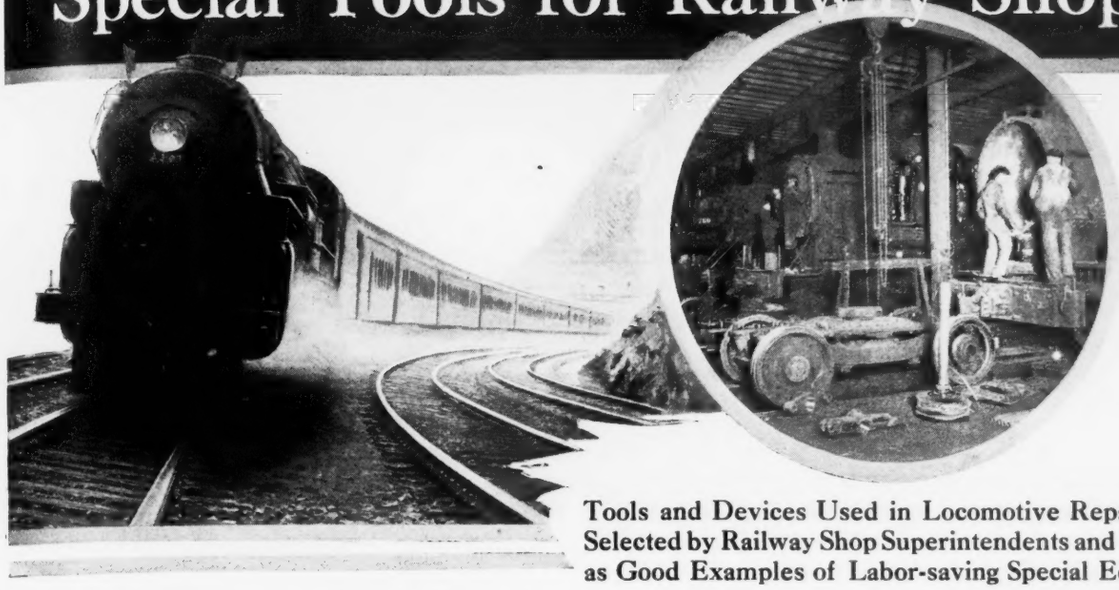
Simple Fixture which Enables One Thousand Bearing Caps to be Chamfered Per Hour

* * *

GROUP SELLING IN INDIA

A group of American machine tool and supply manufacturers have arranged to handle the market in India on a cooperative basis. The group has appointed C. Warren-Boulton of Calcutta as its exclusive representative in India for a term of years. Some twenty-five companies are included in this group, among whom are several leaders in the machine tool and accessories manufacturing field. A cooperative endeavor of this type, organized to make high-class American equipment available to the railways and other industrial establishments in India through direct representation on the ground, is a step that may have far-reaching results. While the group as now formed is not definitely and finally closed, it is not the intention to expand it materially, but manufacturers who may be interested in the proposition should communicate with R. M. Derby, manager of the foreign department, Niles-Bement-Pond Co., 111 Broadway, New York City, or C. J. Stilwell, sales manager, Warner & Swasey Co., Cleveland, Ohio.

Special Tools for Railway Shops



Tools and Devices Used in Locomotive Repair Shops Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Special Equipment

LOCATING ECCENTRIC CAM KEYWAYS FOR STEPHENSON VALVE GEAR

By P. L. NEARY, D. L. & W. Railroad

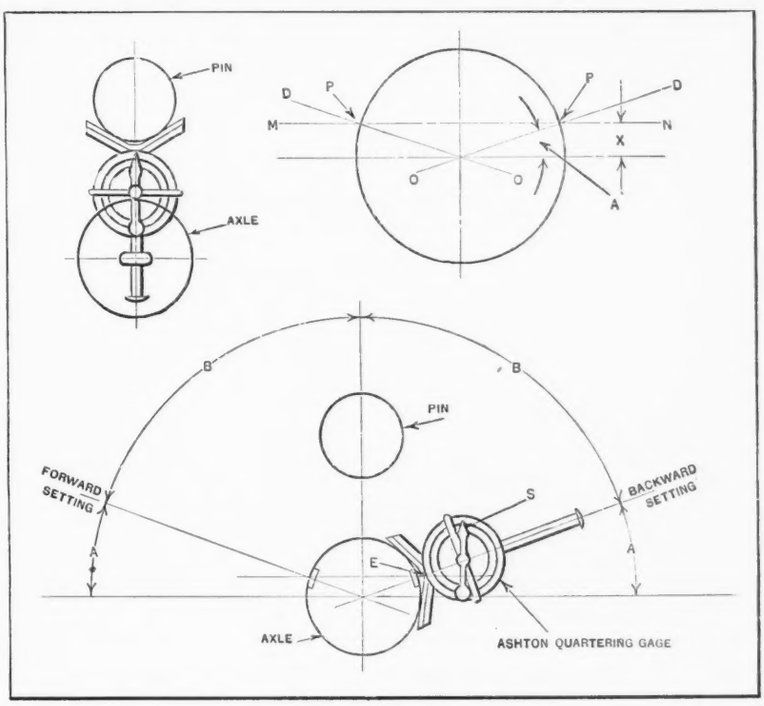
A quick method of locating eccentric cam keyways on main axles of Stephenson-gear locomotives is shown by the accompanying diagrams. This method has proved to be as accurate as that previously employed, which required at least four templets for each position of the four separate cams.

With the new method, an Ashton quartering gage is employed. This gage is used ordinarily for checking up driving wheel crankpins for "quarter." The only alteration made in the quartering gage was to drill a hole at the vertex of the V-locating yoke and insert an indicating pin at *E*. This, of course, in no way interferes with the use of the gage for other purposes. All necessary information for locating the keyways, together with a formula for determining the angular position of the keyway for any engine, is given on a blueprint made up for use in the shop. A table giving all the information required in locating eccentric cam keyways of the ten or twelve engine classes most commonly dealt with is included in the blueprint. There are seven columns in this table arranged as follows:

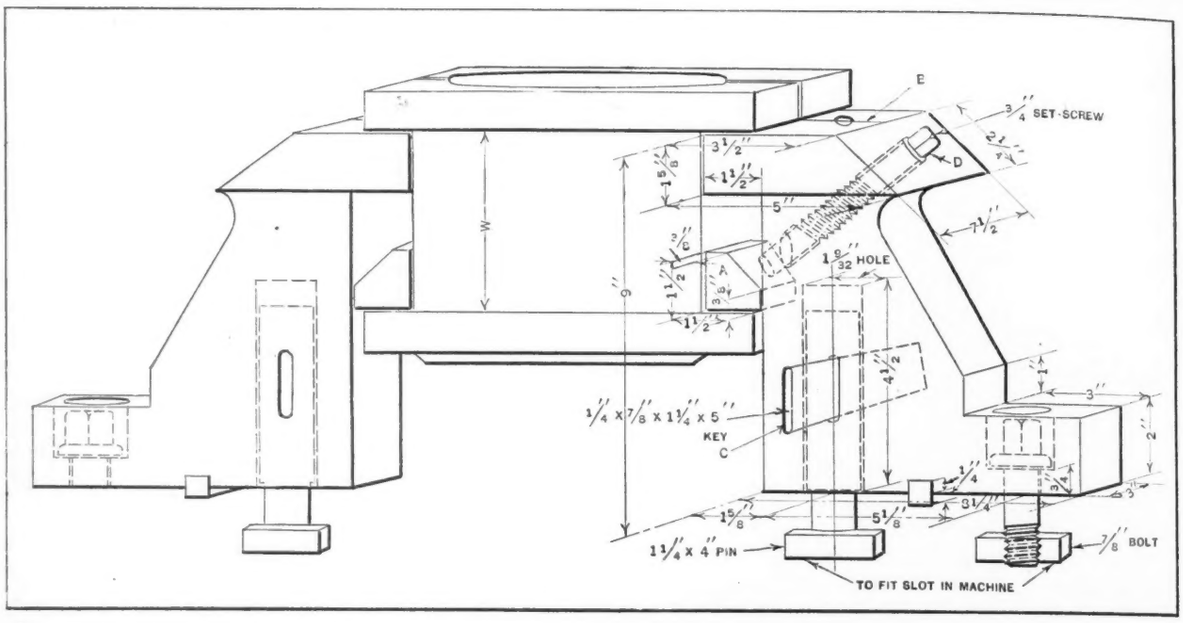
The first column contains the number that identifies the engine class; the second column, the number of degrees in the angular setting of the keyway, as indicated by angle *A* in the diagram; the third column, the number of degrees in angle *B*; the fourth column, the eccentric throw; the fifth column, the length of valve travel; the sixth the steam lap; and the seventh, the lead.

In locating the keyway, the main wheels of the locomotive are set at the top dead center, the Ashton quartering gage being employed as indicated by the upper left-hand diagram. The wheels are set in this manner, one side at a time, and securely blocked to prevent the setting from being disturbed while locating the keyway.

After this, the quartering gage is placed on the axle as indicated in the lower diagram. The gage is inclined until the angular position indicated by the pointer *S* corresponds with the angle given in the tabular data on the blueprint or as may be determined by lay-outs or formulas. The position of the keyway center line as indicated by the point *E* is then transferred to the axle. The front position locates the "backward" cams, and the back position, the "forward" cams.



Locating Eccentric Cam Keyways for Stephenson Locomotive Valve Gear



Chuck for Holding Locomotive Main Rod Brasses while Boring and Facing

For power engines not listed in the tabular data, the angle *A* can be readily determined by making a simple lay-out, as indicated in the upper right-hand diagram. The circle is first scribed with a diameter equal to the eccentric throw of the cam. The line *MN* is next drawn at a height *X* above the horizontal center line, the dimension *X* being equal to the steam lap plus the lead. The lines *OD* are then drawn through the center of the circle and the points *P* at which the line *MN* intersects the circle. The angle *A* which corresponds with angle *A* in the lower diagram can then be measured to determine the gage setting.

SPECIAL CHUCK JAWS FOR HOLDING MAIN ROD BRASSES

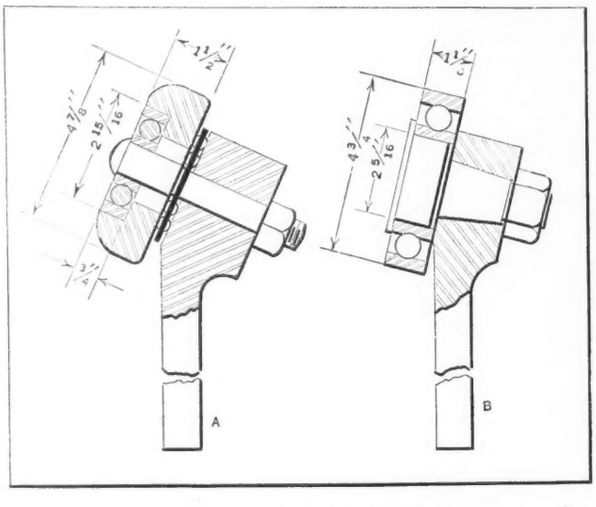
By L. P. EALES, Assistant Supervisor of Piece Work, Cleveland, Cincinnati, Chicago & St. Louis Railway Co.

Special chuck jaws for use in boring and facing back end main rod brasses are shown in the accompanying illustration. This chuck was designed for use on a Bullard boring mill, but can be made to suit any boring mill. A chuck of the same general design can also be applied to a lathe by changing the base to fit the lathe chuck.

With this type of chuck, brasses having any strap width *W* can be held securely in position by employing filler blocks *A* of different heights. These filler blocks are made the same width as the overhand or flange portion of the chuck jaws. Each jaw is held in position on the chuck by one bolt and one pin, the pin being tightened in the jaw by means of a taper key *C*. With this fastening arrangement, the jaws can be secured in position in two minutes. The time required for chucking a brass ready for boring is only two minutes. The rough-boring, finish-boring, and facing operations are all completed in fifteen minutes.

The brasses are not laid out for boring, but are placed in the jaws and allowed to come together at the center line *B*. A line is then scribed on both sides of the brass at points near the bore, using dividers with the point of one leg located in the punch marks on the center line *B*. The marks thus scribed indicate the accuracy with which the brass is centered for the boring operation. If for any reason the work is off center or there is not sufficient stock to permit the bore to clean up, the scribed lines will indicate this fact.

The clamping set-screws *D*, which are set at an angle of 45 degrees, insure holding the top flange of the brass against the upper surface of the jaws. This method of holding the work insures a bore which is parallel with the strap, and is not only more accurate but quicker than the old method of clamping the brass in the main rod strap and then clamping the strap to the machine table. The time required for clamping, laying out, and machining the brasses by the old method totaled approximately fifty-eight minutes, whereas but nineteen minutes is required in machining a brass when using the chuck jaws described.



Burnishers Used in Railway Repair Shops

BALL-BEARING BURNISHERS

By HENRY H. HENSON, Foreman Machine and Erecting Shop, Southern Railway Co.

Burnishers constructed with ball bearings, two types of which are shown

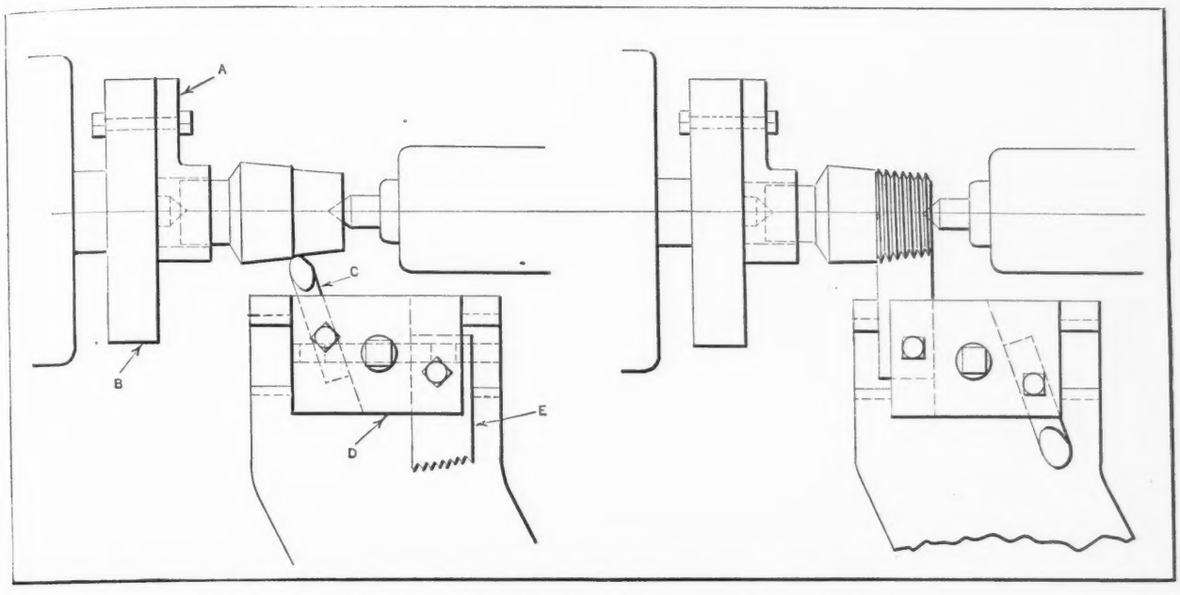


Fig. 1. Tool Arrangement for Machining Arch and Mud Plugs for Locomotives

in the accompanying illustration, are used in railway repair shops. They are also used to finish locomotive crankpins, car journals, piston-rods, valve stems, and other parts that have a surface that needs to be highly polished.

Burnishers *A* and *B* have shanks of about 1 by 2 by 12 inches. Burnisher *A* has a hardened and tempered tool-steel roller, in one side of which is set a ball bearing 2 15/16 inches in diameter. The other side of the outer roller is bored to receive ten rollers, 3/8 inch diameter by 3/4 inch long. This assembly is mounted on a special bolt having a diameter of 7/8 inch next to the button-shaped head. Interposed between the outer steel ring or roller and the head of the tool shank is a thrust bearing, 3 1/8 inches in diameter, which has fifteen 3/8-inch steel balls. The bolt stem that passes through the tool shank head is slightly tapered. Burnisher *B* consists simply of a large ball bearing mounted on the head of a tool shank by means of a special adapter which is a taper fit in the shank.

MACHINING ARCH AND MUD PLUGS

By J. D. STEWART,
Plant Engineer, Atlantic Coast Line Railway Co.

The use of the tools and toolpost arrangement shown in the accompanying illustrations for turning and threading arch and mud plugs for locomotives has doubled the production of these plugs. This tool arrangement has increased the quality of the work, largely due to the perfectness of the threads formed in this way, to such an extent that leaking plugs have been reduced 75 per cent.

The plug is placed between centers in a lathe, as in Fig. 1. The dog *A*, bolted on the faceplate *B*, engages the square head of the plug. The plug is turned to the correct diameter by the turning tool *C*, which is mounted in a swivel toolpost *D* of two stations. The movement of the carriage on which the toolpost is mounted is governed by a taper attachment. After the taper has been turned, the toolpost is indexed one half revolution, so that the chasing tool *E* faces the work, and then the threads are cut. The side of the chasing tool is laid against the inside of the toolpost slot to keep the center line of the threads square with the center line of the plug.

The two-station swivel toolpost, shown in cross-section in Fig. 2, consists of two main sections *F* and *G*, the holding plate *H*, and a 5/8-inch center clamping bolt *J*. The 1/2-inch set-screws *K* and *L* clamp the chasing and turning tools, respectively, in their slots. The center clamping bolt holds the top and bottom sections together, and also clamps the whole toolpost to the lathe carriage by tightening the holding plate in the T-slot. When the center clamping bolt is loosened, spring *M* raises the top section of the toolpost *F*, so that the lugs *N* rise out of the groove in the upper face of *G*. This allows the toolpost to be revolved 180 degrees in changing from turning to chasing.

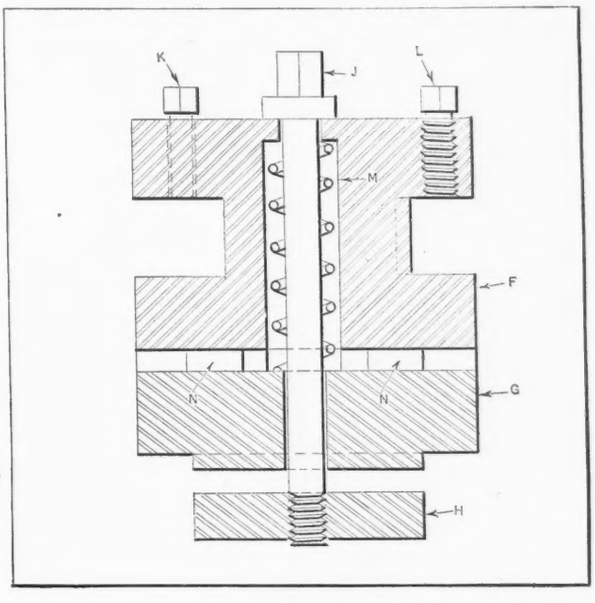


Fig. 2. Cross-section of Toolpost for Holding Turning and Threading Tools

* * *

According to a statement issued by the National Automobile Chamber of Commerce, the automotive freight carried by the railroads in 1927 exceeded 3,267,000 carloads.

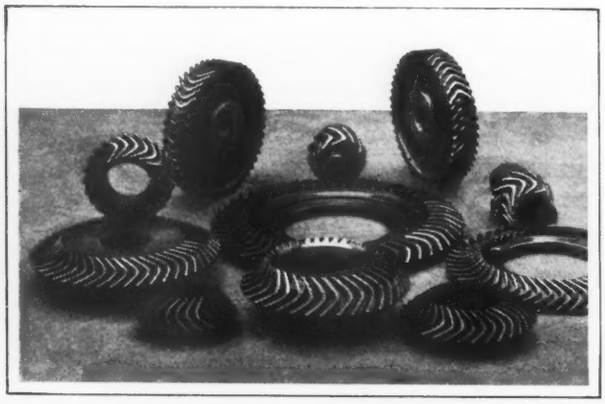


Fig. 1. Spur and Bevel Herringbone Gears Produced by a New German Generating Machine

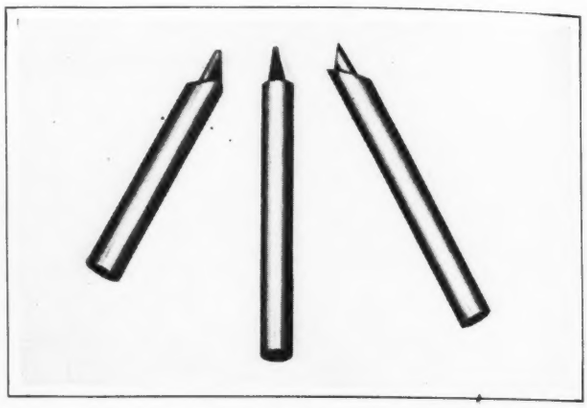


Fig. 2. A Set of Three Tools Used in Cutting the Bevel Gear in Figs. 4, 5, and 6

GENERATING BEVEL HERRINGBONE GEARS

A generating machine for producing both spur and bevel herringbone gears by a method different from those formerly employed has been brought out by a German machine tool builder, Bottcher & Gessner, of Altona-Bahrenfeld. Without going into the constructional features of this machine, it may be of interest to show some of the work performed and some of the steps in the cutting cycle. Fig. 1 shows a number of spur, bevel, and crown gears produced on this machine, which is illustrated in Fig. 3. Fig. 4 shows a cut just started in a bevel gear blank; Fig. 5, the teeth about half completed; and Fig. 6 the fully completed teeth. Fig. 2 shows a set of the tools used, three of which are employed simultaneously in the tool-holding head of the machine.

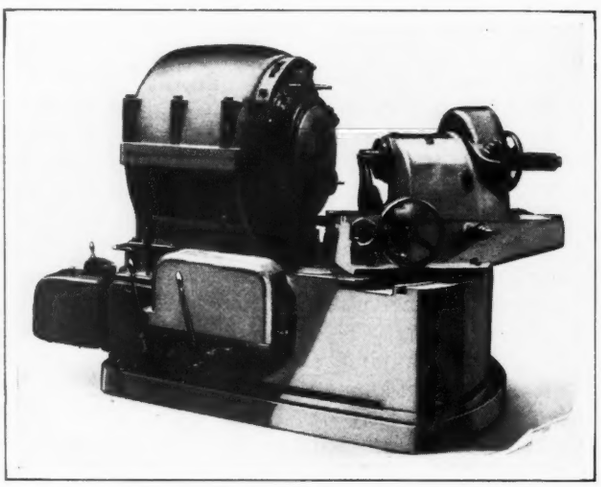


Fig. 3. German Spur and Bevel Herringbone Gear Generating Machine

TESTING MATERIALS MEETING

The thirty-first annual meeting of the American Society for Testing Materials was held at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 25 to 29. Among the many different sessions held, those of particular interest to MACHINERY'S readers were one on wrought iron and cast iron; another on steel and magnetic testing; a third on the wear-testing of metals; and a fourth on the corrosion and fatigue properties of metals at high temperatures. Non-ferrous metals and metallography were also dealt with, and many subjects not directly in the metal field were covered. Complete information in regard to the papers presented may be obtained by addressing the secretary of the society at 1315 Spruce St., Philadelphia, Pa.

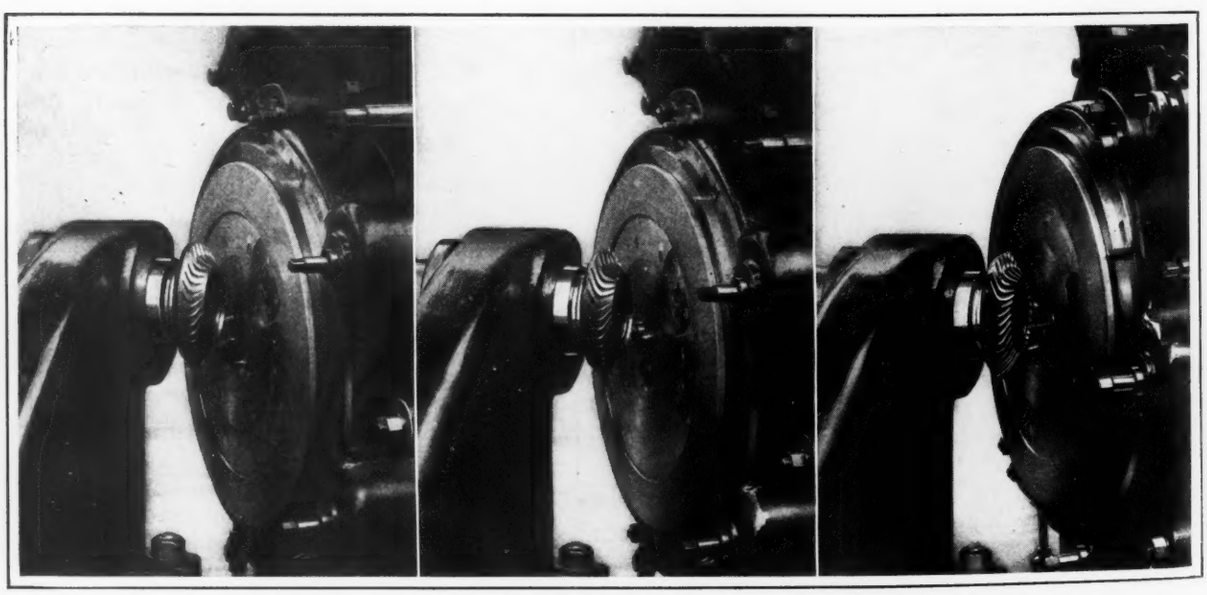


Fig. 4. Starting to Cut a Bevel Herringbone Gear

Fig. 5. The Teeth about One-half Completed

Fig. 6. The Completed Bevel Herringbone Gear

Machine Tool Pulleys

By FRED HORNER

IN a previous installment, published in March MACHINERY, the design of pulleys and methods of mounting on machine tool shafts and spindles were dealt with. The present article also deals with the design of pulleys and their mountings, and in addition, contains descriptions of clutch designs applied to machine tool pulleys.

At *A*, Fig. 6, is shown an idler pulley of the horizontal carriage type, mounted in such a manner that it can be lifted out of the bearing to permit oiling. At *C* is shown a pulley with a special mounting for dead-center grinding operations performed on a grinding machine. This mounting is so designed that the pulley can be removed when the chuck is to be used in the regular manner. For plain fits, a bronze bushing is screwed on the spindle nose, as shown at *C*, and the pulley, with its driver, revolves on the bronze bushing. The arrangement on a well-known universal grinding machine provides for two pulley sizes, the outer pulley being stepped over the inner one and secured in place with a dowel and a screw, as shown at *D*.

On one type of plain grinder, the pulley is fitted with ball bearings, as shown at *B*, Fig. 6. It will be noted that the front end of this pulley, which has the appearance of a faceplate, is slotted to permit adjusting the driving pin to the required radius.

Combination Flywheel and Pulley

A flywheel is commonly used on power presses, but it is seldom used on machine tools. An exception is made, however, in the case of planers made by certain manufacturers. These planers have flywheels which are used as driving pulleys. The wheels are designed to permit instantaneous reversal of the direction of rotation, combined with rapid acceleration. The rim section of the flywheel loose pulley and the light section of the tight pulley used in this machine are shown at *E*, Fig. 6. The design shown in this view is duplicated on the drive at each side of the machine, separate belts being used for the cutting stroke and the return movement of the table.

The flywheel loose pulley is wider than the tight pulley, and as the belt is thrown on the latter, it partially overlaps the flywheel, taking up a portion of its energy and thus easing the strains on the belts and the prime mover. The flywheel is brought into clutch connection with the tight pulley by a slight lateral movement. The belt is shown in the

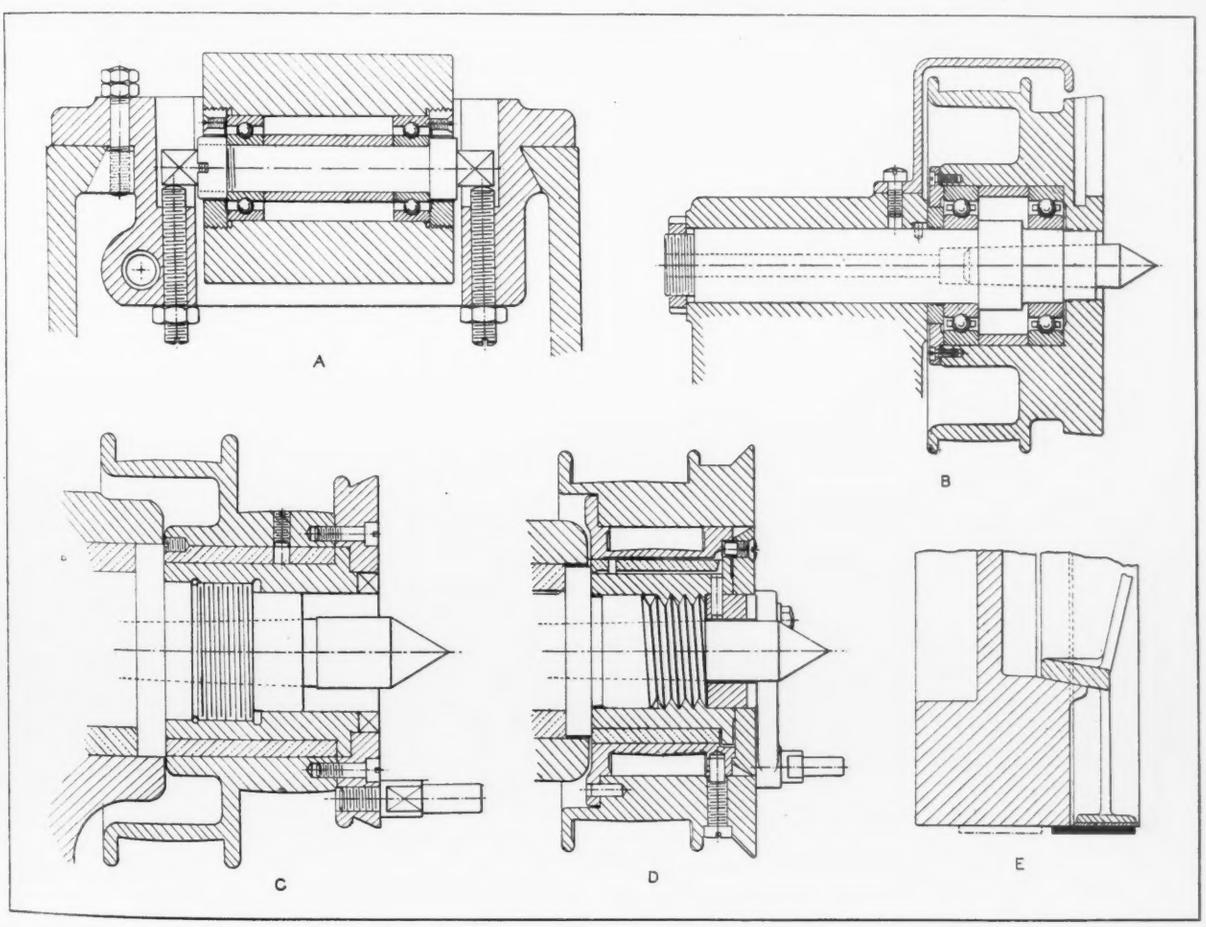


Fig. 6. Idler, Grinder, Dead-center and Loose Pulley Designs

idle position by dot-and-dash lines, and in its driving position by the black cross-section.

Friction Pulley Drives

Friction take-off drives other than those obtained by means of a clutch may be found in some grinding machines, two examples of which are shown in Fig. 7 at *A* and *D*. The design shown at *D* is used for driving a water pump from the tight and loose pulleys of a twist drill grinder. At the end face of the tight pulley is a friction disk, which drives the roller on the vertical spindle of the water pump. The flow of water can be regulated by adjusting the location of the roller on the spindle. Maximum speed of the water-pump spindle is obtained when the roller is in contact with the driving disk at its outermost edge, while minimum speed is obtained when the roller is located close to the center of the disk.

A friction driving rim is the principal feature of interest in the pulley arrangement shown at *A*, which is employed on a tool and cutter grinding machine. A small spindle for internal grinding is adjustably mounted near the main spindle. The small spindle has a collar which can be pressed against the fiber collar shown by the black cross-section, thereby providing a friction drive instead of a belt drive for the small spindle.

The combination of a pulley and gear, with the gear teeth cut on the hub of the pulley, as shown at *B*, Fig. 7, is frequently employed. The combination pulley and gear, which is secured to the shaft, serves to drive the "nest gears" in the work-head of the grinding machine. Internal gears and planetary gears are also frequently employed for back-gear or change-speed drives. An interesting example of planetary gearing for obtaining a slow and powerful drive for such operations as thread-cutting is shown at *C*, Fig. 7. Right- and left-hand pulleys of this kind, for single belts, are suitable for speeds such as are employed for box mills or forming tools.

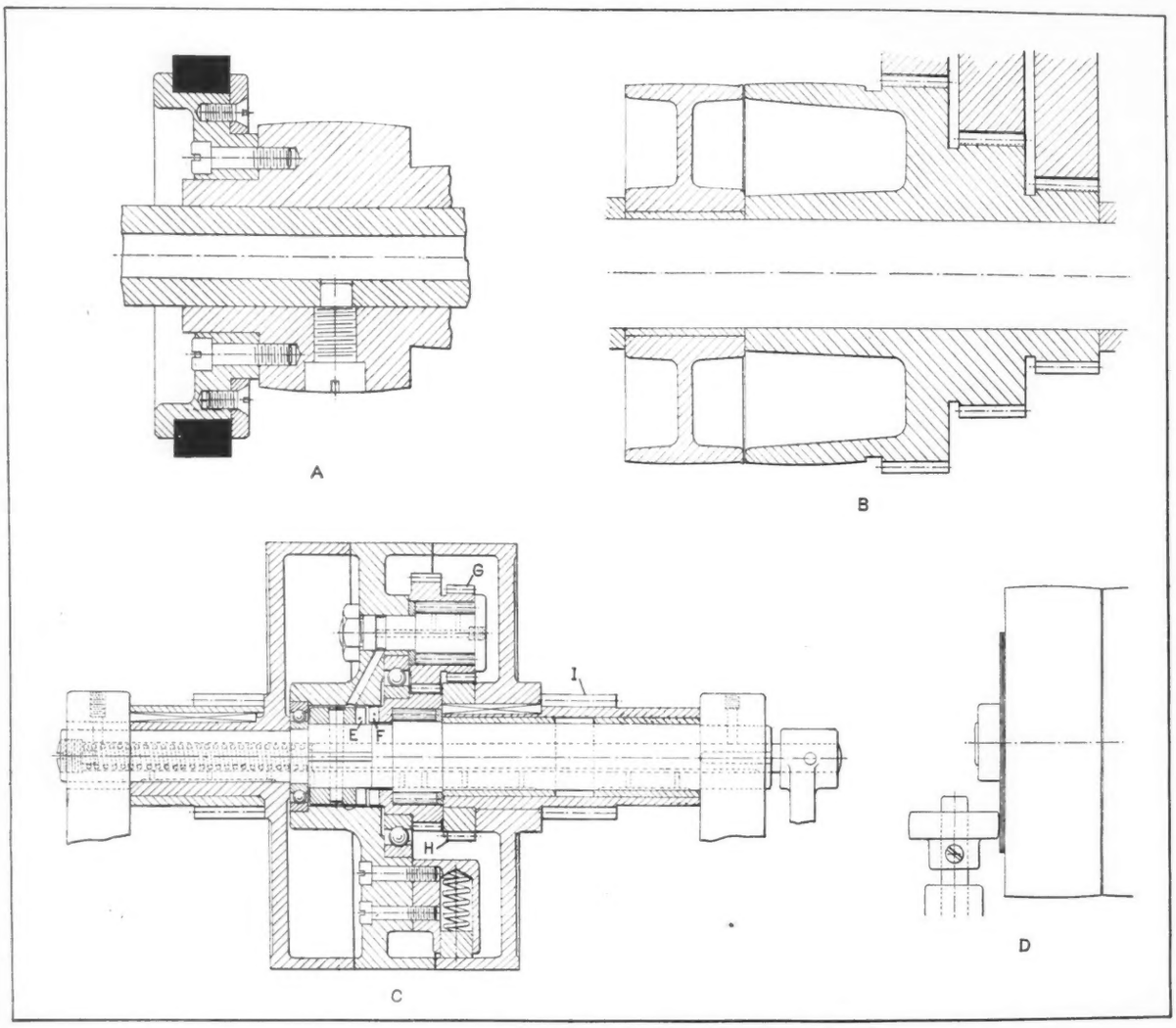


Fig. 7. Friction Pulleys and Pulleys with Gears

The central pulley, mounted on ball bearings, operates through a set of hardened steel epicyclic gears. When the belt is shifted to the central pulley, the clutch *E* is also actuated and engages gear *F*. As the clutch slides upon a square section on the shaft, the effect is that of holding gear *F* stationary while gear *G* rotates around it. The gear *H* thus turns the pinion collar *I*, which provides a powerful drive to a pinion that meshes with the front spindle gear. With clutch *E* disengaged, the train of gears runs free, and the belt may be shifted to the central pulley from either the right- or left-hand pulley, the same as with the ordinary arrangement.

The practice of incorporating a friction clutch within a belt pulley has increased within recent years. It provides a rapid and smooth means of starting and stopping a machine. A good example of the ordinary cone clutch is shown in Fig. 9. This type of clutch is used on the cone pulleys of turret lathe headstocks. The design shown, however, is more complicated than is generally required for a turret lathe. The two pulleys for forward and reverse motions must withstand extremely severe duty at high speeds. Roller bearings are therefore provided, and steel and bronze thrust members employed. Oil reservoirs are incorporated in the design to insure efficient lubrication.

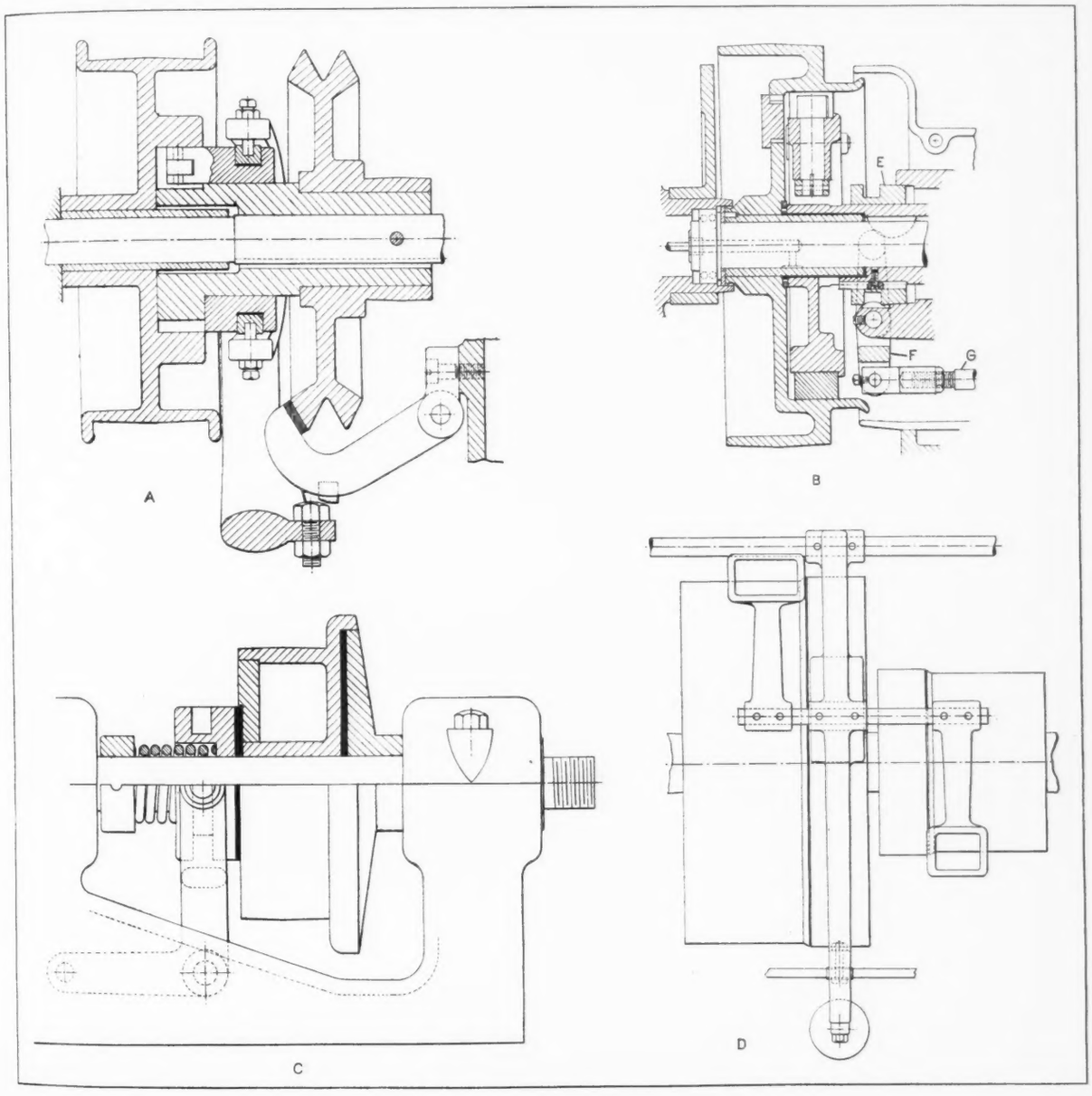


Fig. 8. Machine Tool Pulleys with Brakes for Stopping Rotation

Brake Arrangements for Stopping Rotation

A great many machine tools, particularly lathes, have a brake included in the pulley and friction clutch equipment. Sometimes a simple arrangement of the parts enables the clutch to operate as a brake, while in other designs, a separate part provides the braking surface. Two kinds of braking devices for driving pulleys are shown at *A* and *B*, Fig. 8.

At *A* is shown the main driving pulley of an automatic screw machine having an expanding band clutch. In this design, there happens to be a V-groove pulley at the side of the main pulley. A brake lever is brought into action against the rim of the V-groove pulley, which serves to drive the various attachments as well as a brake-drum. A backward motion of the starting member serves to disconnect the clutch and at the same time apply the brake.

In the design shown at *B* the pulley is used on an automatic milling machine. This design has a thimble *E*, which is moved by the yoke *F* and rod *G*, the thimble being connected with the clutch-expanding cam. When the clutch is thrown out of engagement, the tapered end of member *E* is forced into the recess in the adjacent bearing, thus producing the braking action.

Braking mechanisms are employed in some grinding machines to check the speed of the work-

spindle and often to cut off the water supply at the same time. A lathe head may also be equipped with a brake, actuated by the movement that controls the air-operated clutch and chuck. Hand or speed lathes for short quick operations require instantaneous stopping devices. These are generally controlled by a foot-treadle.

In one make of lathe, the purchaser has the choice of two types of friction drive headstocks, using fiber or leather washers for the driving and braking surfaces. With one type, the spindle starts to revolve when the operator steps on the treadle, and stops when the treadle is released. With the other type, the spindle stops when the treadle is depressed. The pulley in which this feature is incorporated is shown at *C*, Fig. 8. In this design, the bellcrank lever is connected to a foot-treadle. There may be two steps on the cone or only one, as shown in the illustration.

Applying a braking force on the pulley rim is a feature found in some machines, particularly broaching machines of certain sizes. The fast and loose pulleys for the cutting and the quick return strokes are so designed that the belt shipper exerts pressure on a brake-shoe in the manner indicated at *D*, Fig. 8, where a weight supplies the pressure. Control is obtained through a cam bar at the front of the pulleys and the roller on the extended end of the striker lever, which rides on the cam bar.

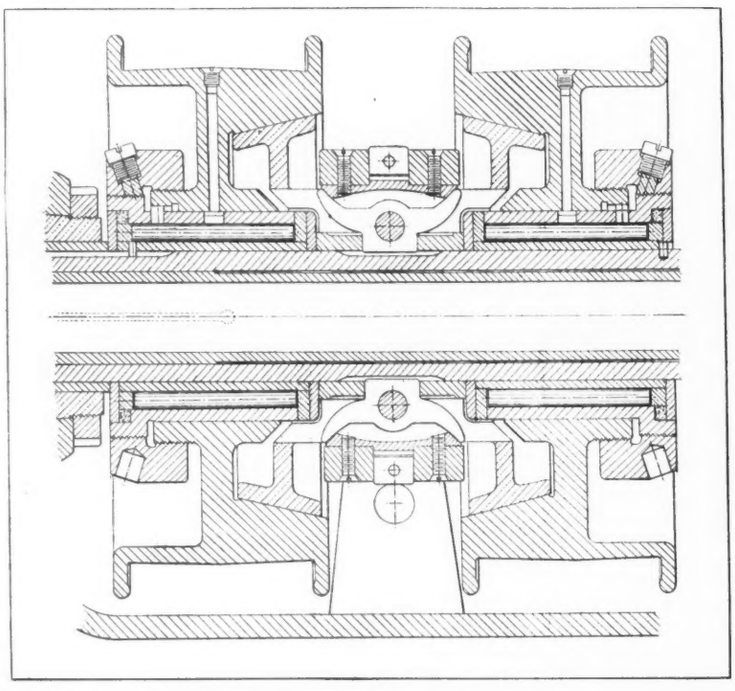


Fig. 9. Clutch Pulley Equipped with Roller Bearings for Severe Service

The drop on the cam allows the roller to move downward, thus permitting the weight to exert its braking pressure.

Among other things incorporated in pulleys may be mentioned crank disks, roller power-feeds, indexing plates, worm-wheels for indexing purposes, and grinding wheel seats. The grinding wheel seat may be cast on the pulley with the flange at the right-hand end or the flange may be screwed on the pulley hub, as in the case of the design illustrated at *A*, Fig. 10. Occasionally, a rounded rim for hand adjustment is required. A separate wheel may be keyed to the shaft, as in the case of the design shown at *B*.

Adjustable Belt Guard

There are many auxiliary features incorporated in pulley designs that do not come within the scope of this article, as, for instance, various kinds of belt-shifting devices and belt guards. Belt guards may consist simply of netting or perforated metal formed into tube-like covers, which extend up to a point where the belt is beyond the operator's reach. Such guards can often be swiveled or set at any desired angle. One example of a cast-iron covering, however, is shown at *C*, Fig. 10, in which slotted belt holes are provided to enable the guard to be set to the required angle. The belt shifter is attached to the exterior of the casting.

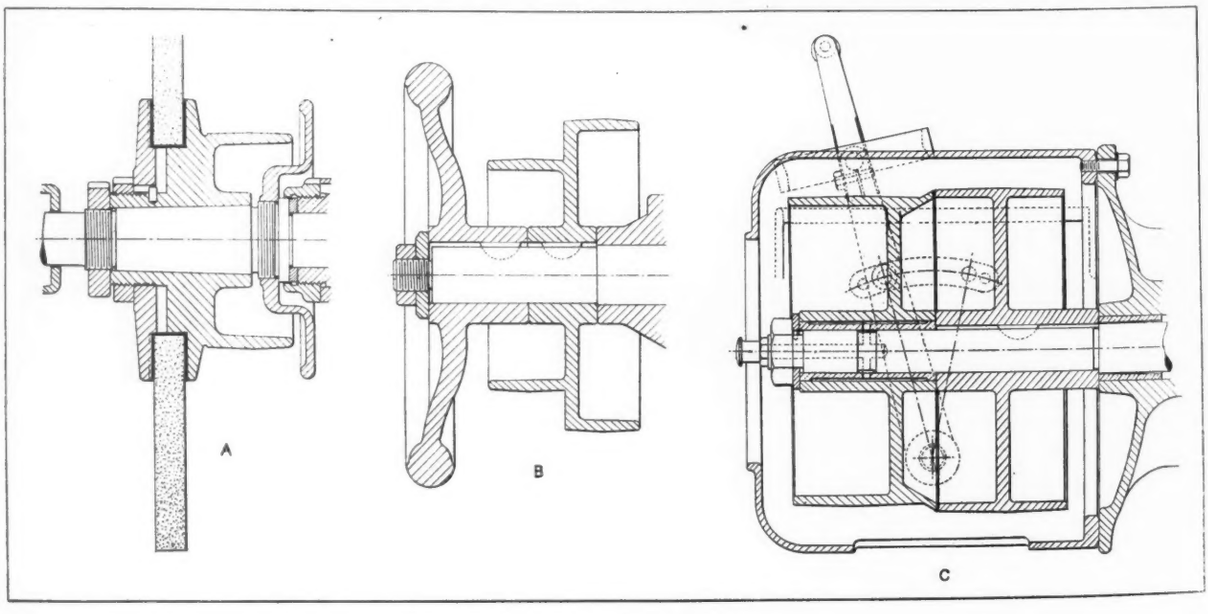


Fig. 10. Pulleys with Special Attachments

Special-purpose Flat Surface Grinding

Obtaining High Production Rates by the Use of Machines Designed to Handle One Part

By CHARLES O. HERB

ADVANTAGES derived from the use of single-purpose machines were briefly discussed in an article published in May MACHINERY, which described a number of machines produced during the last few years by the Gardner Machine Co., Beloit, Wis. These machines were designed for grinding flat surfaces on automobile, electric-washer, and other parts, by employing either abrasive disks or ring wheels. Several other single-purpose machines of these types possessing features of unusual interest will be described in the present article.

Grinding Automobile Flywheel Housings

Automobile flywheel housings of the type shown in Fig. 1 are ground on both sides by the use of the special machine illustrated in Fig. 5. The housing is mounted on one of the machine tables for grinding the first side and then on the second table for grinding the opposite side. Approximately 1/16 inch of stock is removed from each surface ground, the surfaces being held to a parallelism of within 0.006 to 0.010 inch. The production averages forty housings per hour, with two operators. Thirty-inch G.I.A. grinding disks are used.

Fig. 1. Automobile Flywheel Housing Ground on Both Sides with Abrasive Disks

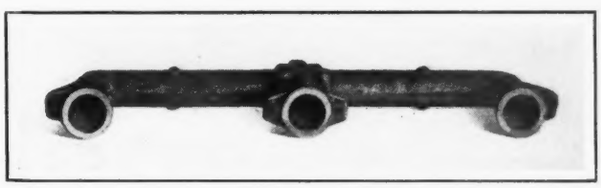


Fig. 2. Manifold Ground on the Machine Shown in Fig. 3

Flexibility of control is obtained in this operation through the use of hydraulic equipment for actuating both the longitudinal traverse and transverse in-feed of the two tables. The hydraulic equipment for each side of the machine is started by a convenient lever, and is stopped automatically. When either table traverse is started, the in-feed functions at a fast rate until the work comes in contact with the abrasive member, after which the in-feed changes automatically to a slower rate, which continues until a stop is reached, at which point the feed is ended. The number of table reciprocations varies with the area ground on the work. Fixtures on which the work can be accurately and quickly loaded are provided on the tables. One motor drives the spindle of the grinding members, and there is a separate motor for the hydraulic pumps.

Intake and exhaust manifolds of automobiles are ground on the surfaces surrounding the ports, by using the machine illustrated in Fig. 3. A typical manifold finished in this manner is shown in Fig. 2. The machine used for this operation has an abrasive ring-wheel, and its table is equipped with an indexing fixture, so that a manifold can be loaded ready for swiveling into line with the wheel as soon as the preceding manifold is finished. Another feature that facilitates production is the hydraulic traverse and in-feed of the table.

The hydraulic equipment is ordinarily started by manipulating the horizontal lever *A*. This lever can also be employed to stop the machine in an emergency. When the hydraulic mechanism is started, a preliminary cut is taken on the work as the table makes its first longitudinal movement past the grinding wheel. Before the return stroke, the table moves 1/32 inch in toward the wheel, so that a finishing cut is taken on the work during the return stroke. At the end of the return stroke, the table again moves outward, and stops automatically.

These manifolds must be so ground that the finished port surfaces are in a straight line within 0.004 inch, about 1/16 inch of stock being ground off the ports. To insure accuracy, the manifolds are seated in three V-blocks *C*, and lugs on the ends of the manifolds rest on two adjustable stops *D*. Two hinged overhead clamps *E* are tightened on top of the manifold by means of the handwheels. This operation is performed dry at an average production of 75 manifolds per hour. The manifolds are iron castings. The ring-wheel is 18 inches in diameter.

Rounding 240 Curved Meter Magnets per Hour

Fig. 6 shows a special double ring-wheel grinder equipped with mechanically oscillated work-tables and special fixtures designed for rounding the adjoining ends of curved meter magnets such as seen at *A*, Fig. 7. Since the tables oscillate automatically, one operator can attend to both sides of the machine. With this arrangement, an average produc-

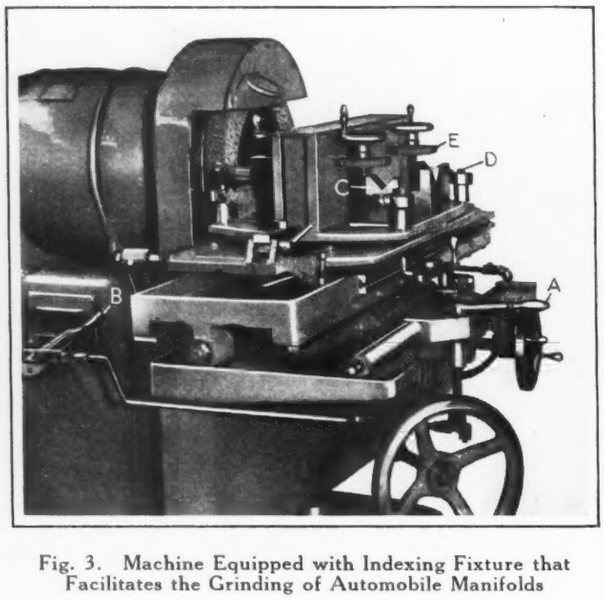


Fig. 3. Machine Equipped with Indexing Fixture that Facilitates the Grinding of Automobile Manifolds

tion of 240 parts per hour is maintained. The parts are of magnet steel, and are ground wet.

From Fig. 7 it will be seen that each magnet is seated on three hardened and ground steel blocks, and is securely gripped on these blocks by clamp *B* when handle *C* is swung downward. The clamp has a slot in it to permit moving it lengthwise along block *D* so as to facilitate reloading the work. After a part is loaded, handle *E* is employed to lift the table into the working position, as shown, and to automatically start the oscillating mechanism. Handle *F* is then operated to release a plunger from latch *G*, so that spring *H* can feed the work gradually toward the grinding wheel until the table reaches a stop. This stop can be set through micrometer screw *J* to closely control the amount of stock removed. As the work-table oscillates back and forth across the wheel, part *K* of the fixture swivels back and forth on its pivot to bring each side of the meter magnet in contact with the wheel.

Grinding Straight Meter Magnets

Straight meter magnets about 6 1/4 inches long are ground to a bevel on each end by means of two machines equipped as illustrated in Fig. 4. One end of the magnets is ground to an angle of 27 degrees in one machine, and the other end to an angle of 45 degrees in the second machine. These magnets are of a tapered cross-section that measures 11/16 inch on one side, 7/8 inch on the other side, and is 3/8 inch thick. They are made of steel and are ground wet on a ring-wheel 18 inches in diameter. From 1/16 to 1/8 inch of stock is ground off each end, the parts being held to length within 0.015 inch. Only one pass is taken across the wheel, twelve ends being averaged per minute per machine.

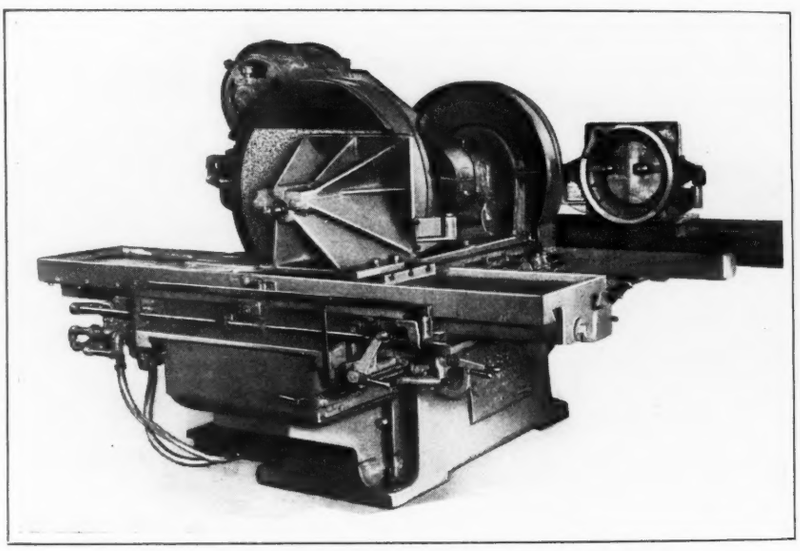


Fig. 5. Hydraulically Operated Machine Employed in Grinding Both Sides of the Flywheel Housing Shown in Fig. 1

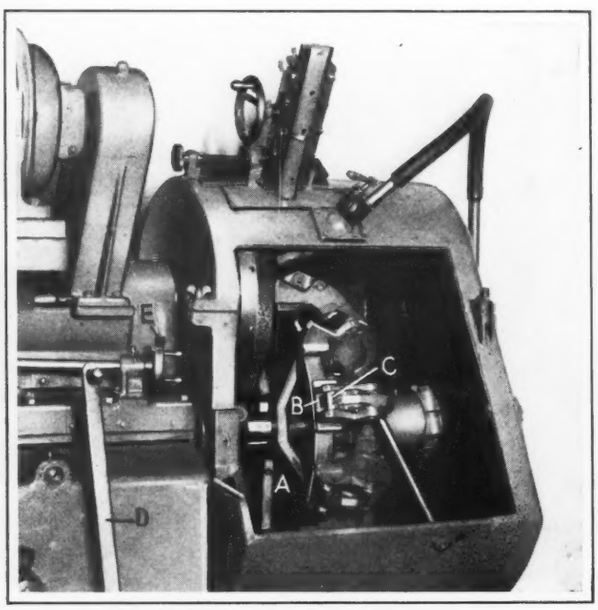


Fig. 4. Equipment Employed in Beveling the Opposite Ends of Straight Parts to Different Angles

The work of the operator consists wholly of loading the fixtures as drum *A* revolves slowly. Each magnet is slipped into a fixed lower block *B*, which is slotted to hold the part rigidly at the correct angle relative to the grinding member to produce the desired bevel. The magnet is located against a stop to gage it for length. At the time of loading, a cam holds the hinged clamp *C* upward from block *B*, but after the work has been loaded and the drum carries it toward the grinding wheel, clamp *C* is released and a spring action causes it to grip the magnet firmly. At the end of the grinding operation, clamp *C* is automatically released, and the work is unloaded by the force of gravity.

The only difference between the two machines used for grinding the opposite ends of these magnets is that the fixtures are differently inclined to grind the ends at the two desired angles. The machines themselves closely follow the construction of that shown in Fig. 8 of the previous article published in May MACHINERY. Lever *D* is employed to start or stop the rotation of drum *A*, while the

graduated handwheel *E* is revolved to make minute adjustments of the grinding wheel relative to the work. In an actual operation, the work drum and the grinding wheel are completely covered by guards, with the exception of a small opening that permits reloading.

Finishing Both Sides of Gear Blanks

Small brass gear blanks, 1 3/4 inches outside diameter, are ground on both sides by means of the equipment illustrated in Fig. 8. Two of these blanks are shown at *A*. The surfaces ground are rims about 1/4 inch wide. From 0.010 to 0.012 inch of stock is removed over all. The blanks are held to a specified thickness within limits of plus or minus 0.002 inch, and the two sides must be parallel within 0.001 inch. Two G. I. A. 10-inch disks having very small central holes are employed. These disks have no lateral movement during the operation, but can be adjusted accurately relative to the work to compensate for wear.

The production on this operation averages 1200 gear blanks per hour, as the operator merely has to push the blanks between guides which carry them between the abrasive members. The top and bottom guides *B* and *C* extend through the machine and thus support the gear blanks during the operation. The side guides extend only from the front of the machine to the disks and from the disks to the rear of the machine, where the blanks slide on a chute which conveys them to a container. It will be seen that a dressing device of rigid construction is conveniently mounted on top of the disk hood to provide for keeping the abrasive members trued.

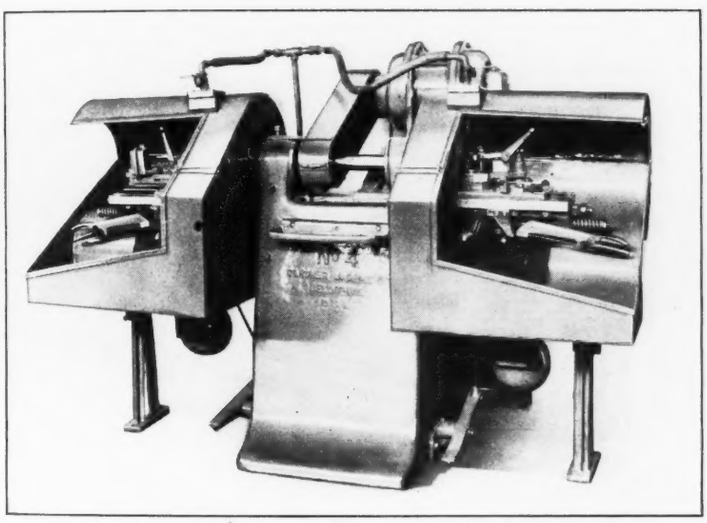


Fig. 6. Double-wheel Machine Used for Rounding the Joint of Curved Meter Magnets

* * *

Norway, Canada, and the United States, in the order mentioned, lead the world in the per capita consumption of electricity. The per capita output of electricity in Norway is 2400 kilowatt-hours; in Canada, 1320 kilowatt-hours; and in the United States, 690 kilowatt-hours. This information is given in a report on the output of electricity of public utility power plants in the United States in 1927, issued by the Geological Survey, Washington, D. C.

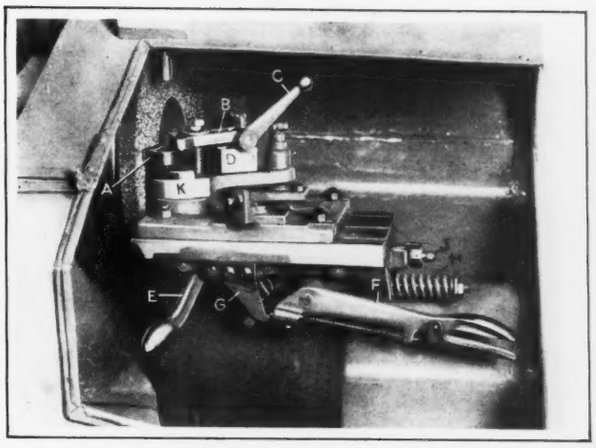


Fig. 7. Close-up View of the Meter Magnet Rounding Operation

GERMAN COMMERCIAL AIR SERVICES

Last year saw a great development in the commercial air services of Germany. A regular service was opened between Berlin, Prague, and Vienna, and between Berlin, Copenhagen, and Malmo, the two services being so arranged that the distance between Malmo in Sweden and Vienna in Austria may be covered in one day. A line between Munich and Milan was organized, although no regular service was started, but experimental flights showed that the regular crossing of the Alps by airplane does not offer any particular difficulties. A service between Stettin and Oslo in Norway via Copenhagen and Gothenburg, and another service between Berlin and Genoa and Marseilles by way of Stuttgart and Bale (Switzerland) were inaugurated. There is also a service between Marseilles, Barcelona, and Madrid in Spain, so that all the European countries, with the exception of Poland, are now connected through regular air service, an important new mode of travel being thus established.

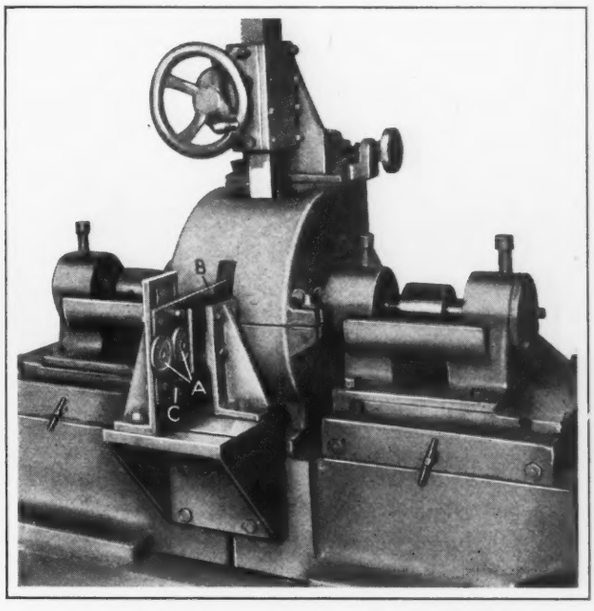


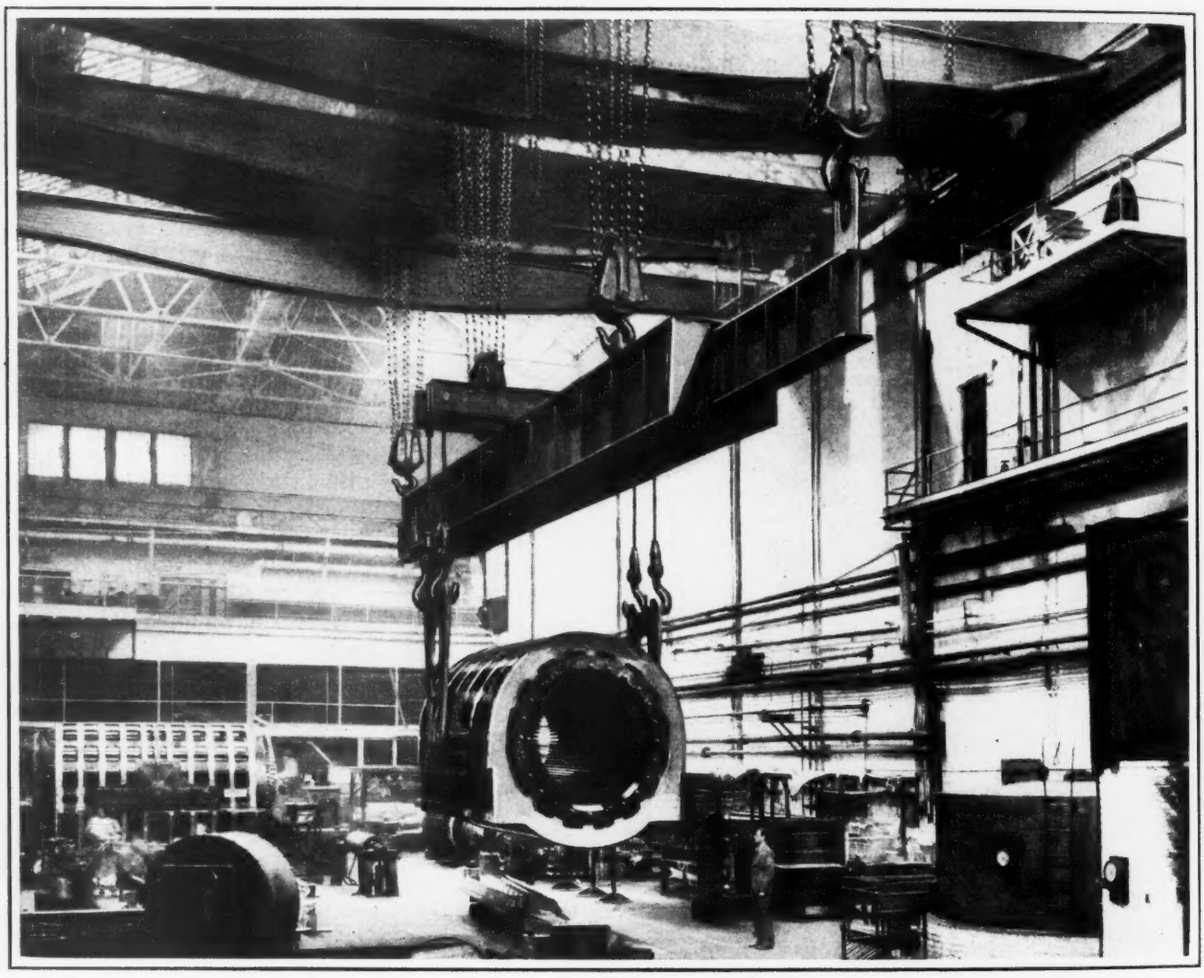
Fig. 8. Grinding the Faces of Small Gear Blanks at the Rate of 1200 per Hour

FOUR FIFTY-TON CRANES SERVE AS ONE

By ROGER L. KNIGHT, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

The accompanying illustration, taken in the large machinery aisle at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co., shows four 50-ton cranes attached to a 70-foot structural steel, arc-welded "whiffle-tree," and lifting a 116-ton stator of a 69,000-KVA turbo-generator being built for the Hudson Ave. Station of the Brooklyn-Edison Co. These stators will be shipped complete on specially built railway cars.

The construction of this large lifting beam, weighing 42 tons, is interesting for two reasons: First, it makes it possible to assemble, complete, large electrical machinery in the shop of the manufacturer instead of building it in sections and assembling it in the field; second, it presents a very interesting problem in plant engineering and represents another achievement in the arc-welding of structural steel.



Four 50-ton Cranes Arranged to Lift a 116-ton Stator in the Westinghouse Plant at East Pittsburgh

Immediately two solutions of the problem of lifting heavy loads presented themselves; either one large crane might be installed to carry these loads, or some method might be devised whereby four of the cranes already installed could be used in parallel. The installation of a large crane was out of the question, because by its use, the loads would be distributed over such a short length of the crane girders and columns of the aisle that they would have to be rebuilt to carry these loads. The second method was adopted, because it was found cheaper to build the lifting beam than to reconstruct the building to carry one large crane. By using four cranes in parallel, the loads are distributed safely along the structure.

The beam resembles a huge double whiffle-tree, this construction being necessary to divide the loads evenly between the four cranes. The two smaller beams to which the cranes are attached are fastened to the ends of the main beam by two large steel pins, forming two bearings. The two short beams shown laid crosswise on the main beam, and carrying the four lifting hooks, are only clamped to the main beam, so that they can be moved anywhere along this beam. This makes it possible to adjust the equipment easily to suit various kinds of lifting jobs. Steel plates with large holes cut in them are used to hook over the trunnions which are attached to the apparatus to be lifted. This construction, also, adds to the flexibility of the device.

Arc-welding was used on this lifting beam as the cheapest method of fabrication. All steel for the job was cut at the mill, no parts being sent through a fabricating shop. Calculations and test have proved that arc-welded girders have the maximum of strength with the minimum of weight. Evidently weight was one of the most important items of design in this beam.

Loads lifted by the process described in this article are carried on with surprising speed. It might be thought that considerable difficulty would be met with in getting the four cranes to work together smoothly, but on the first lift that was attempted, no such difficulty was experienced, and the crane operators had practically no previous instructions.

The question might be asked, "How are these large electrical machines handled in the field?". The answer is that the power houses for which they are intended are designed for and equipped with 150-ton cranes, which, with 10 per cent overload, will handle the largest machines that have yet been built.

* * *

WELDING BRAKE-BEAM FULCRUMS IN A FORGING MACHINE

Forging machines are sometimes employed for welding or joining pieces of steel or iron. Fig. 1 shows three typical brake-beam fulcrums welded and upset at the upper ends in machines built by the Acme Machinery Co., Cleveland, Ohio. They are made of mild steel bars, 2 1/2 inches wide and 1/2 inch thick, which are twisted 45 degrees at each end. The lower ends are bent in addition to being twisted. The twisting of the upper ends is accomplished in a forging operation. These bending and forging operations are performed before the bars are welded. The welding operation on the brake beams is effected without using a flux.

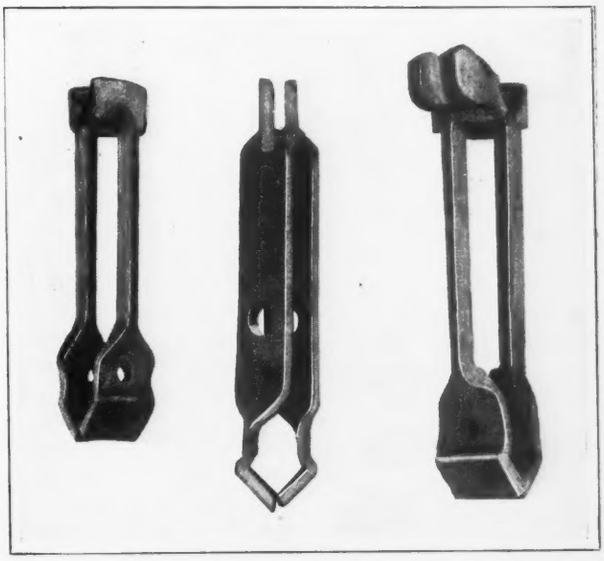


Fig. 1. Three Brake-beam Fulcrums which are Welded Together and Upset at One End

Figs. 2 and 3 show, respectively, the dies and tool employed in welding and upsetting the upper end of the brake beam seen in the center of Fig. 1. Before being placed in the dies, the bars are heated to about 2150 degrees F. A bar is inserted in each impression *A* of the stationary die, the bent section at the upper end of one bar being supported by wall *B*. When the movable die advances into contact with the stationary die, each bar is firmly gripped in impressions *A*, and the bent upper end of the second bar is supported by wall *C* of the movable die. Then the welding and upsetting tool, the working end of which is shown in Fig. 3, advances to upset the end and weld the two bars to each other.

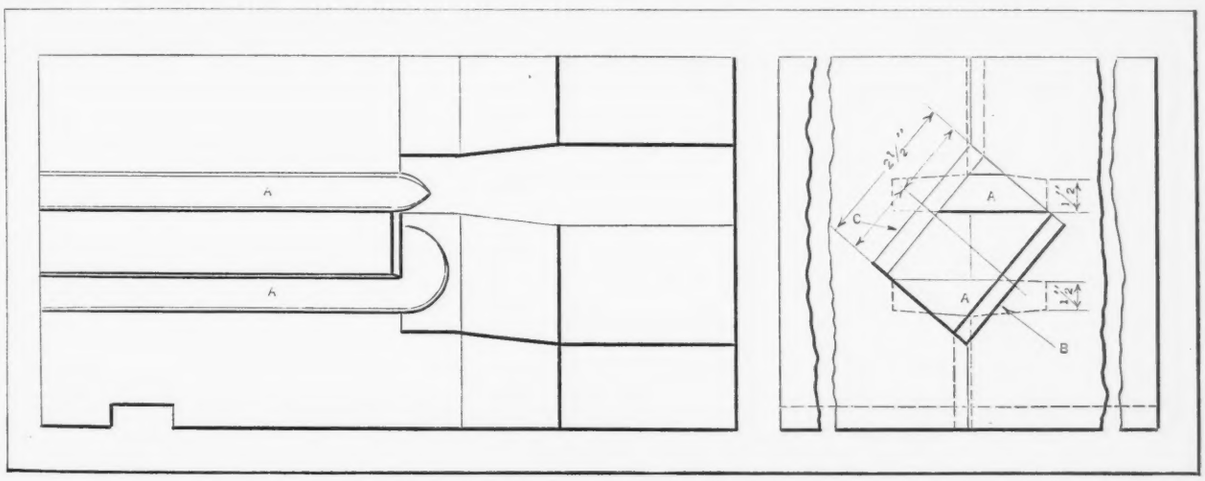


Fig. 2. Construction of the Dies Employed in the Welding Operation

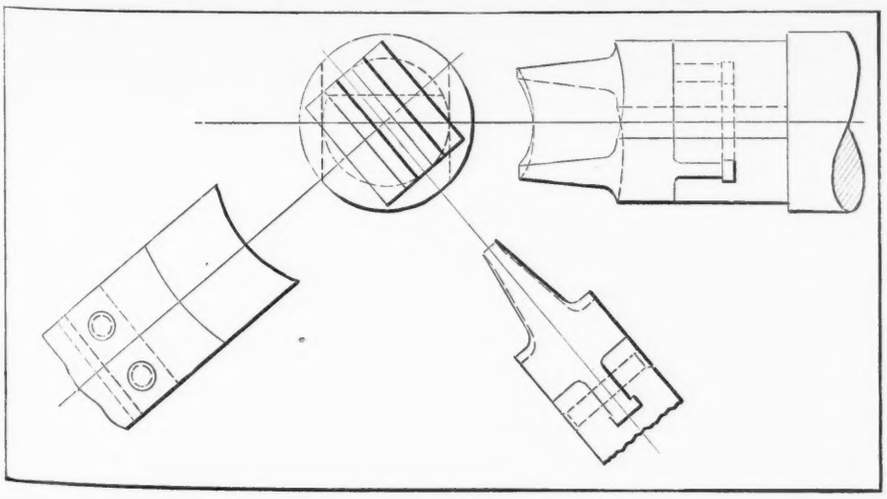


Fig. 3. Design of the Upsetting Tool Employed in the Welding Operation

The other two brake beams shown in Fig. 1 are produced in a similar manner.

PROJECTION MACHINE IN SALES WORK

By CLARENCE E. GOOD

Many manufacturers of instruments and machinery are using optical instruments to sell, demonstrate, and instruct men in the use of their equipment. Sales and service engineers in large numbers are now carrying a small portable still projection machine which they use in illustrating their sales arguments or in demonstrating to numbers of men the proper uses, care, and operation of the equipment made by the firm that they represent. This small projector, commonly known as a "sales projector," uses strip film, and projects still pictures up to about 3 feet square, depending, of course, upon the darkness of the room in which the pictures are shown and the type of lens on the projector.

One of the most popular types of projector is only about 7 by 9 by 3 1/2 inches in size and weighs less than 6 pounds. It is complete in itself with the bulb and extension cord inside, as well as reels for handling up to 200 frames of standard motion picture size film. Illumination is provided with a 100-watt bulb and the pictures are controlled through a small handle on the outside of the case. They may be moved up or down as desired, allowing the salesman or instructor to retrace previous points in explaining or clarifying the picture he is showing at the moment.

The only preparation necessary for the projection of pictures in a small room is to tack up a piece of white cardboard, in case a white smooth wall is not available, and connect the extension cord to an available light circuit.

The film is prepared by taking such photographs as may be necessary, making the required drawings, and writing titles that will explain these photographs or drawings. Having prepared the necessary drawing and photographs, they are all photographed in their proper order on a strip of film, printed in the usual manner (as many prints as required) and distributed to the salesmen or service men.

* * *

BRAZING A BAND SAW

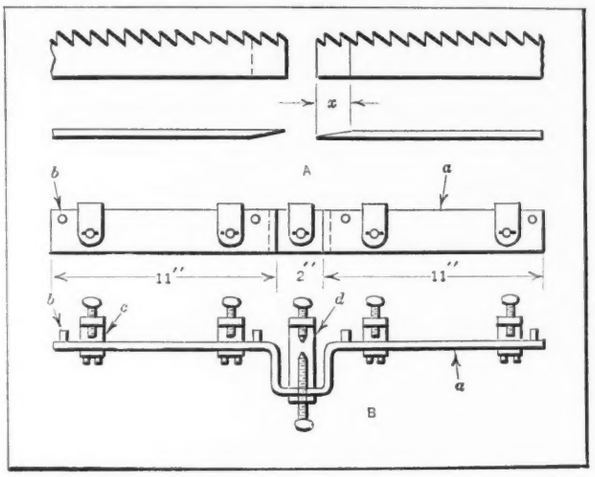
By E. J. JORDAN

A method of brazing band saws which has proved satisfactory is described here with the hope that it will be helpful to those who may be called on to handle this kind of work. First, a frame such as shown at *B* in the accompanying illustration is necessary for holding the saw when the joint is being scarfed, as indicated at *A*, and for clamping the saw ends in place while brazing. The frame *a* is made from a piece of mild steel bar stock 1/2 inch thick and 2 inches wide. This frame is fitted with four aligning pegs, one of which is shown at *b*. Four clamps *c* and a center clamp *d* for holding the work are secured to frame *a* by machine screws.

The length of the scarfed joint *x* should not be more than 3/8 inch for a saw 1/2 inch wide, and not more than 1/2 inch long for a saw 1 inch wide, a short joint generally being preferable to a long one. The scarf is considered well made when the filed surfaces fit well together and the joint is slightly thicker than the saw. If possible, the scarf should begin and end at the middle of a tooth.

For brazing, use silver solder; this can be bought in ribbon form or if this is not obtainable, a small silver coin beaten out very thin and of sufficient area to cover the joint can be used. For flux, use a paste made of borax and water. After being properly scarfed, the saw ends are clamped in the frame ready for brazing, the two ends being lined up by placing their back edges against the aligning pegs *b*, at the same time matching the teeth.

Great care must be taken to have the saw joint and the brazing material perfectly clean and free from contact with the fingers. The joint and the silver solder are covered with the borax paste, after which the solder is placed in the joint. The brazing is generally done by pressing together the scarfed ends thus prepared, using red-hot tongs. A better joint can generally be obtained by using two iron pads instead of the tongs. Each pad should be about 3/4 inch wide, 1 1/2 inches long,



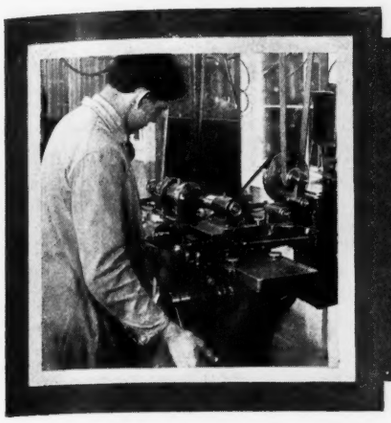
Band Saw Scarfed for Brazing and Frame Used to Align and Clamp Saw Ends in Place

and 1/2 inch thick, with handles about 18 inches long made from 1/4-inch rod. These handles are welded to the ends of the pads. The pads must have flat faces and should be freed from scale and trued up each time they are used.

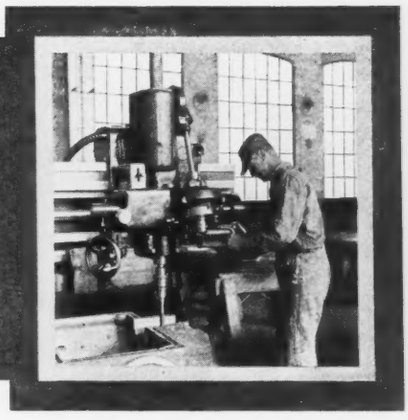
The pads are heated to a bright red and are then placed one above and one below the joint. The pads, with the saw ends and brazing material between them, are then tightly clamped together by the top and bottom screws of clamp *d*. While the pads are still red-hot, the handles can be given a side to side movement, which tends to heat the joint more uniformly and at the same time prevents the pads from being brazed to the saw. The pads can be removed soon after cooling below the red-hot temperature. Then the saw can be slid along the frame to a convenient position for draw-filing. Both sides of the saw are draw-filed until the joint is the same thickness as the rest of the saw.

* * *

In 1927, 61 per cent of the automobiles manufactured were sold on an installment basis. In 1925, 75 per cent were sold in that manner. The difference between these two figures indicates a more conservative attitude on the part of automobile manufacturers and dealers.



Letters on Practical Subjects



CAM MILLING ATTACHMENT

The accompanying illustrations show the construction and application of an attachment for milling the outer bearing surface of internal cams, using the finished inner cam surface as a guide for the end-mill *E*. The bracket *A*, Fig. 1, is attached to the dovetail on the column of the milling machine. The outer end of this bracket carries a guide *B*, the body of which is turned to the same radius as the roller that is to be used in the cam groove.

A hole is bored through guide *B* and bracket *A* to allow end-mill *E* to enter the cam groove. The hole is eccentrically located to bring the circumference of the end-mill tangent to the circumference of the guide *B*. The distance *X*, indicated in the diagram in Fig. 1, is therefore equal to the diameter of the cam roller. The cam *C* is mounted on a revolving table, as illustrated at *D*, which is so located that its center of rotation is in a plane passing through the center of rotation of the end-mill.

The guide *B* is set slightly lower than the cutting face of the end-mill *E* so that it will enter the groove first. The feed-screw of the table *F*, Fig. 2, is disengaged from contact with the lead nut. Weights are attached to table *F* to keep the inner cam surface in contact with guide *B*, as indicated in the diagram in Fig. 1.

The rotary table *D* is given the required revolving motion by means of the handle *G*. At the same time, the table *F* is made to move back and forth through the action of guide *B* on the cam surface. With this arrangement, the outer edge of the groove in cam *C* is machined concentric with the inner cam surface at all points. When the groove in cam *C* is cut to nearly the required depth, the bracket *A* is raised to permit end-mill *E* to cut to the bottom of the groove.

Philadelphia, Pa. R. H. KASPER

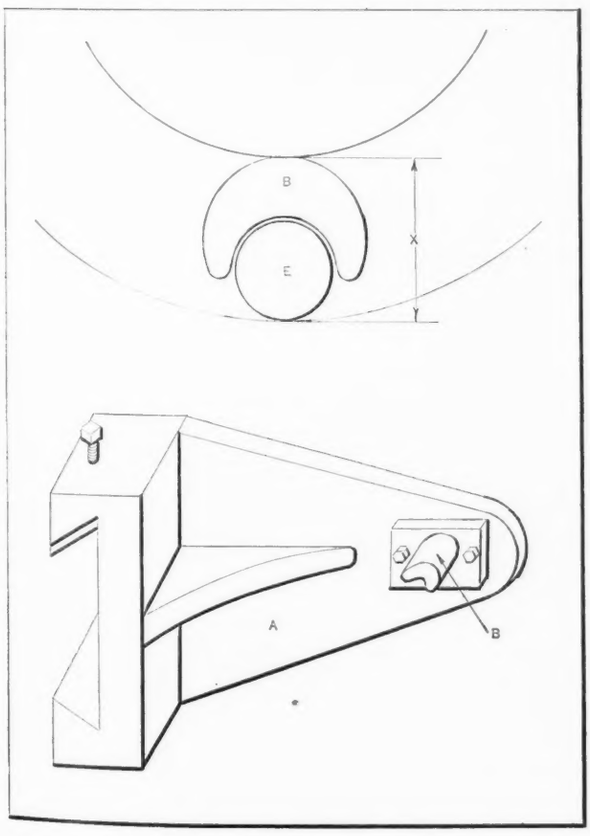


Fig. 1. Guide Used in Milling Outer Surface of Internal Cam Groove

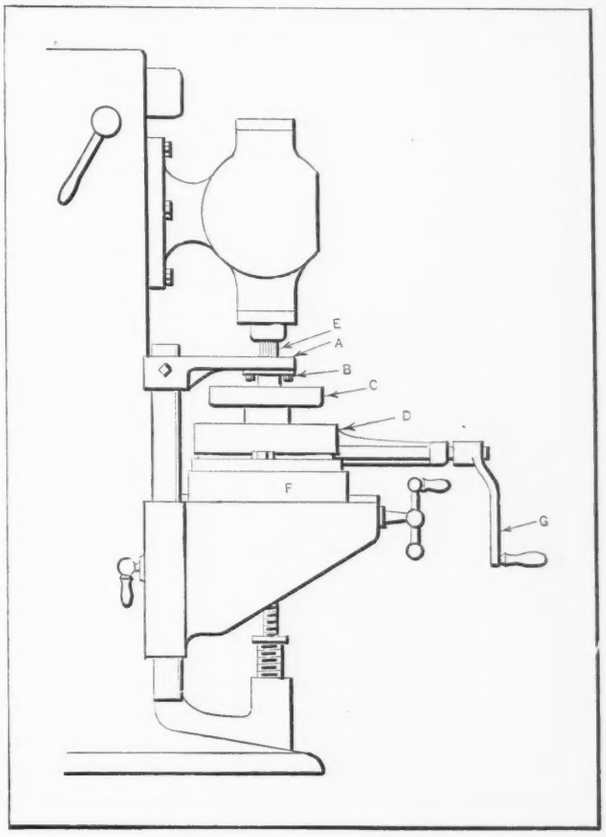


Fig. 2. Milling Machine Set-up for Milling Internal Cam Groove

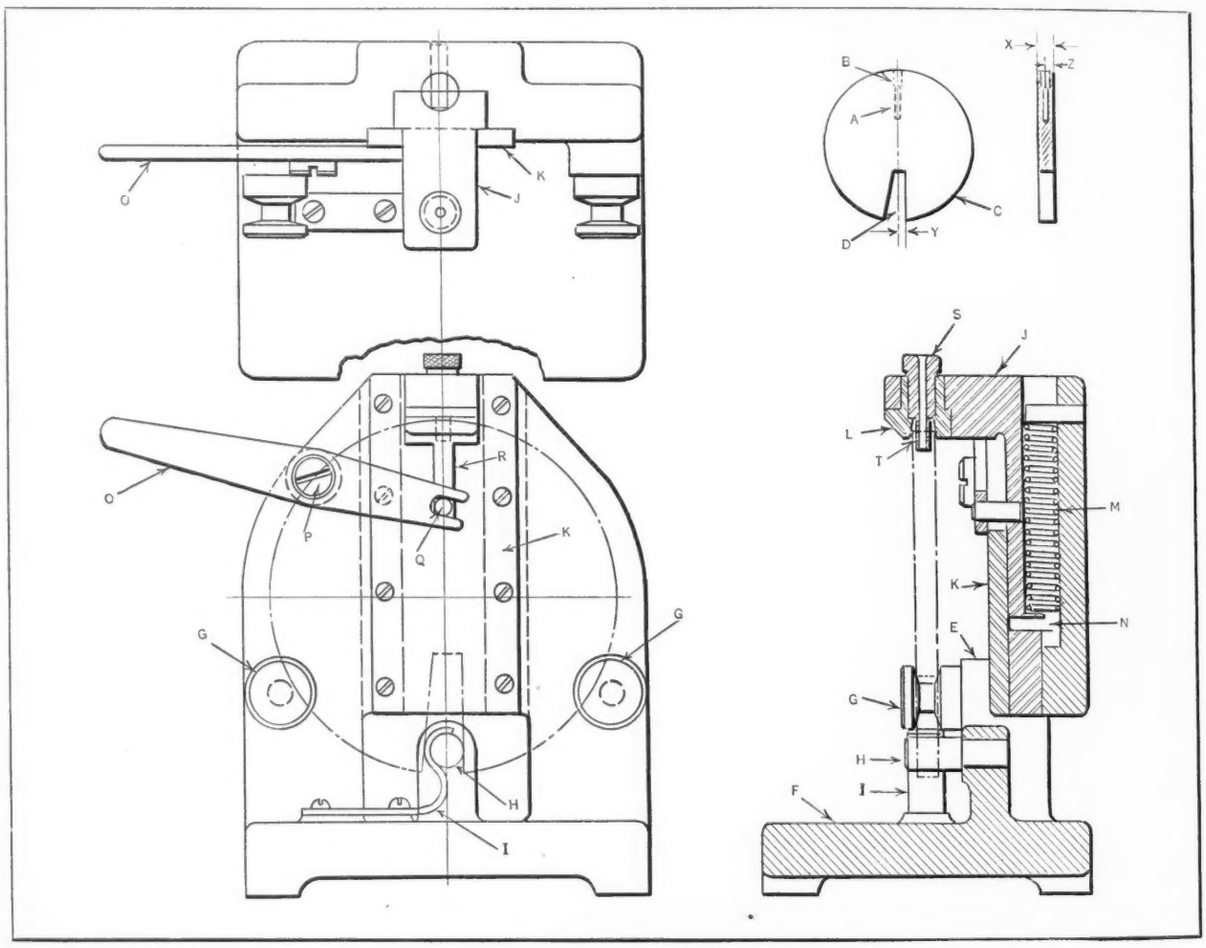
JIG FOR DRILLING AND COUNTERBORING HARD RUBBER DISK

The accompanying illustration shows a drill jig for drilling and counterboring the holes *A* and *B* in the hard rubber disk *C*. This disk is first finished all over to very close dimensions, after which the slot *D* is milled. It will be noted that one side of this slot is cut on a radial line, while the other side is parallel with the center line. After the slot is cut, the hole *B* is drilled in the rim of the disk. It is necessary that this hole be located a distance *Z* from each side of the disk, the dimension *Z* being exactly one-half the dimension *X*, or the thickness of the plate. The hole must also be on the center line passing through the center of the milled slot.

On the two finished pads *E* on the face of the angle-plate *F* are mounted the hardened and ground pins *G*. These pins are spaced 120 degrees apart, and each has a V-groove cut in it, which is designed to receive and locate the edge of the disk, as shown in the section view. At *H* is located a hardened and ground stop-pin, the radius of which is the same as dimension *Y* of the slot in the disk, so that the straight side of the slot, bearing against the stop-pin, locates the disk in the proper position for drilling the holes *B* and *A*. A flat spring *I* secured to the base is coiled half way around stop-pin *H*, so that it bears against the angular side of the disk slot, thus tending to force the straight side against the stop-pin.

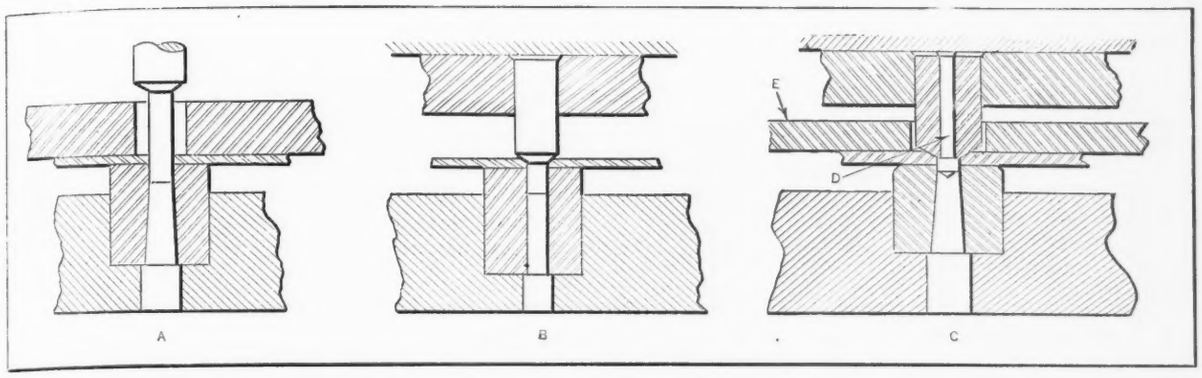
A groove is cut in the face of the upright member of the angle-plate. The block *J* slides in this groove and is retained by the plate *K* secured to the base of the angle-plate. The sliding block *J* has a projection or overhanging ledge at the top in which are located the drill bushings which seat in the hardened bushing *L*. This bushing has a V-shaped slot at the bottom similar to the V-grooves in the pins *G*. This V-shaped slot is located in the same plane as the grooves in the pins.

A stiff spring *M*, located in a hole at the back of block *J*, exerts pressure against the pin *N*, which is driven into the sliding block. The action of spring *M* thus tends to press block *J* downward. A handle *O*, which is pivoted in the angle-plate at *P*, has a slot at the end which fits over the pin *Q*. This pin is driven into the sliding block and projects through a slot *R* in the retaining plate *K*. The bottom of slot *R* also serves as a stop for the downward travel of the sliding block *J*.



Jig for Drilling and Counterboring Hard Rubber Disk

The operation of the fixture is very simple. The handle *O* is first pushed down, causing the sliding block *J* to rise against the pressure of spring *M* until a disk can be slipped into the grooves in the pins *G* in such a manner that the straight side of the slot *D* bears against stop-pin *H*. The pressure on the handle now being relaxed, the sliding block is forced down by the spring until the V-groove in bushing *L* strikes the edges of the disk. The pressure of spring *M* forces the disk down into its seat in the V-grooves of pins *G*, and also forces the slot in the disk down against the pressure of the flat spring *I*, thus bringing the straight side of the slot in positive contact with stop-pin *H*.



(A) Die for Piercing Sheet Metal for Screw Holes; (B) Countersinking Die; (C) Die Combining the Operation of Dies A and B

The disk is thus rigidly held at three points, in the correct location for the drilling operation. The large hole *B* is first drilled to the correct depth. The drill bushing is then removed and another bushing *S*, shown in the section view, slipped into place. This bushing contains a projection *T* at the end which fits into the hole previously drilled so that the smaller hole is accurately centered with respect to the axis of the larger hole. After the drilling operation, handle *O* is depressed until the sliding block is raised high enough to permit bushing *L* to clear the disk. The drilled disk is then removed and replaced by another disk, and the drilling operation repeated.

New York City — B. J. STERN

PIERCING AND COUNTERSINKING IN ONE OPERATION

In the accompanying illustration the views at *A* and *B* show the usual method of piercing and countersinking holes in sheet steel. This method is a costly one. The method illustrated at *C* eliminates one die by combining the two. The piercing punch *D* is turned down to a diameter smaller than the pierced hole, and shoulders against the bottom of taper punch *E*. The piercing and countersinking punches are thus made in two parts, so that there will not be any sharp edge on the tapered end of punch *E*.

The work is slightly embossed below the countersink, and the metal is bulged out along the edge of the metal (No. 18 gage), as the center of the hole is about 9/32 inch from the edge. This, however, also happens when dies *A* and *B* are used, and is not objectionable in this case. The elimination of one operation has reduced the cost of this work 50 per cent.

Ypsilanti, Mich. — FLOYD GRAVES

QUICK-OPERATING CHUCK FOR LIGHT WORK

The quick-operating chuck shown in Fig. 1 was made to hold a very light and flimsy drawn shell (Fig. 2) for finish-turning. Because of the perforations, the part could not be gripped readily without distortion. The delicacy of the part and the accuracy required will be understood by referring to Fig. 2. The material is 0.035-inch drawing steel. It must be turned round, and the turned surface must be square with the face.

Shaft *A*, Fig. 1, is tapered at one end to fit the lathe. The other end is a taper fit in the chuck body *J*. The front end of the chuck body is shouldered to receive the part to be machined. To three lobes on the body are pivoted three chuck fingers *G*. Screwed to the back end of the chuck is a spring retaining ring *B*. Clutch ring *T*, to which is fastened a finger bearing plate *F*, slides on the chuck body and is caused to rotate with it by key *C*.

Shifter lever *D*, pivoting on a bracket fastened to the lathe ways, carries two rollers which are held on the vertical center line of the chuck body and in the circular groove of the clutch ring. When lever *D* is pushed backward, clutch ring *T* is carried against ring *B*, removing any pressure from the clamping fingers. The close-wound spring *L*, which passes through the holes in the fingers, causes them to pivot enough to be able to insert the work in the chuck. When lever *D* is released, the four springs

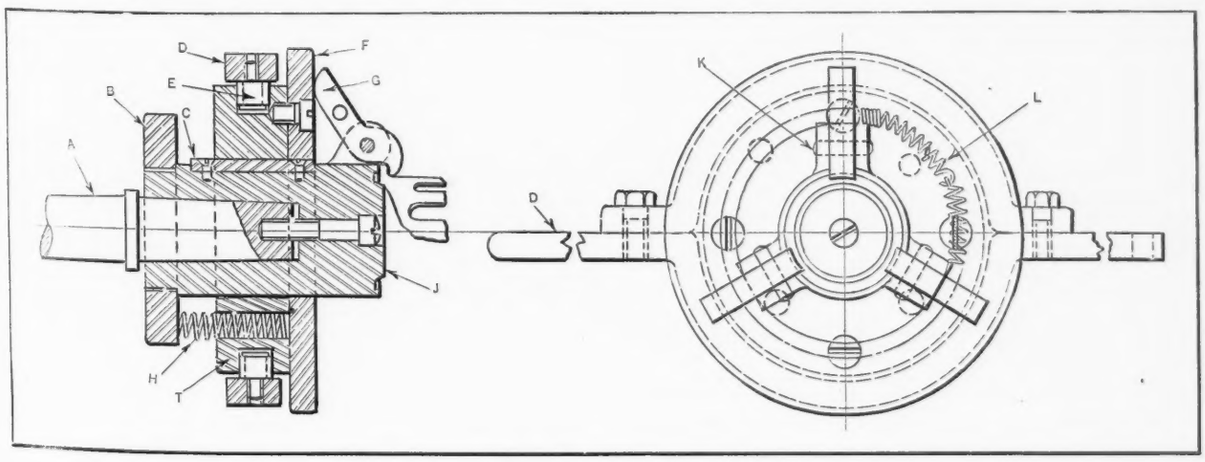


Fig. 1. Chuck for Clamping and Centering Work without Distortion

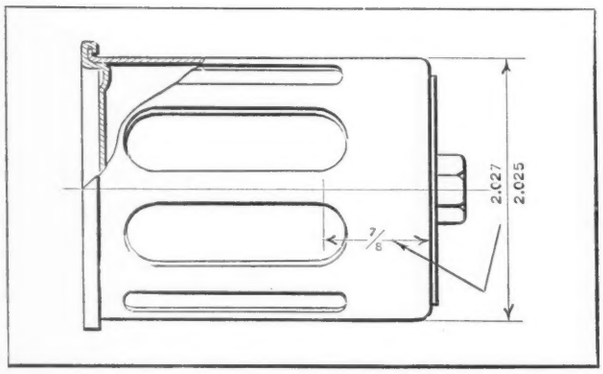


Fig. 2. Drawn Steel Shell to be Turned Square with the Base within Close Limits

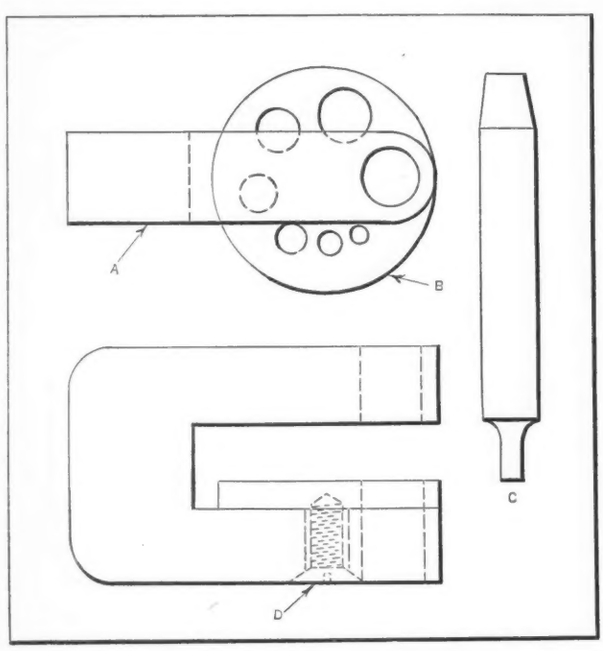
H cause the chuck ring *T* and plate *F* to move forward against the clamping fingers *G*, thus pressing the clamping ends against the work. The four springs *H* are strong enough to hold the work securely.

In order that all three fingers shall have an even pressure against the work, the bore of the clutch ring *T* and plate *F* is made bell-mouthed on both ends. This allows the whole unit to rock a little. All parts are hardened and ground. The use of this chuck reduced the time required for the operation 60 per cent over the previous set-up, which required tedious centering and the loosening and tightening of three or four clamps.

Cleveland, Ohio — HERMAN SCHMID

PIERCING PUNCH FOR EXPERIMENTAL WORK

A tool that has been found very useful in experimental and model shops for piercing holes of various sizes in sheet-metal parts is shown in the illustration. It consists of a frame *A* of cold-rolled steel, in which is pivoted a disk *B* of tool steel having a series of reamed die holes of the sizes most commonly used. The disk is hardened and may be ground when the cutting edges of the die holes become dull. Drive punches similar to the one shown at *C* are provided for each size hole.



Piercing Punch for Experimental Work

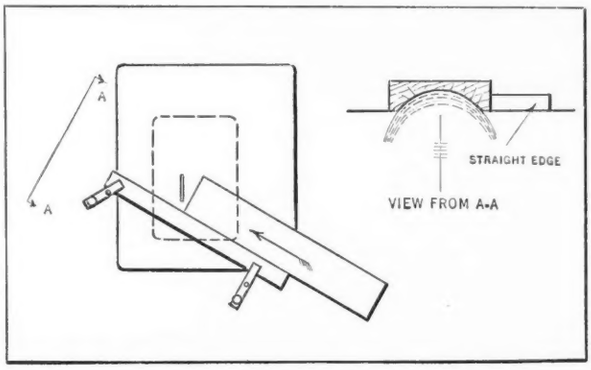
The shanks of these punches are all made a slip fit in the guide hole in the upper part of frame *A*, and the cutting ends are turned to fit the die holes in the disk. In using the tool, a punch of the desired size is first inserted in the guide. The flat-head screw *D* is then loosened sufficiently to allow the disk to be rotated until a die hole of the required size is lined up with the punch. The punch is inserted in the die to obtain accurate alignment, and screw *D* tightened to lock the disk in place.

Ontario, Cal. — H. R. HAGEMAN

CUTTING ARCS OF LARGE RADII

The accompanying illustration shows a novel method of forming a curve of large radius on furniture molding. This kind of work is usually done on a wood shaper, but if only a small amount of molding is required and a shaper is not available, hand gouging may be avoided by this method. The idea should prove useful in small pattern shops.

The illustration shows a plan view of the saw table with a straightedge clamped at an angle in front of the saw. The arc should previously be



Cutting Arcs of Large Radii—View at Right Shows Successive Cuts of Saw

scribed on the end of the stock for guidance. For the first cut the saw should protrude about 1/8 inch above the table and should be raised slightly for each successive cut, the straightedge meanwhile being adjusted so that the final cut will be right on the line scribed. The stock is fed obliquely across the saw each time the saw is raised, and if it is fed slowly, the surface will be smooth enough to be finished by sandpapering. The best saw to use is a cross-cut saw of fairly heavy gage, with fine teeth. Such a saw is stiff and makes a smooth cut.

The radius of the molding shown in the illustration is only 3 1/2 inches, but a curve with a much larger radius can be cut. To cut a nearly perfect arc of a circle, a saw whose radius is nearest to that required should be used. When a large saw is used to cut a curve of small radius, the curve produced is an arc of a parabola instead of an arc of a circle.

Muskegon, Mich. — H. W. RAMBOW

GRINDING CASTINGS TO SAVE CUTTERS

Both the milling and the grinding machine are production tools of undoubted merit, and one may supplement the other on the same operation to advantage.

The illustrations show three gray iron castings, which it was found profitable to grind previous to milling. Fig. 1 is a part required by the thousands; Fig. 2 may be made up in lots of from one to twenty; and Fig. 3 is a piece required in lots between these extremes. Hence, the principle is not confined to one kind of work.

The faces marked *G*, Fig. 3, are less than 1 inch wide and average 15 inches long. They were machined with a high-speed end-mill running at 200 revolutions per minute and at a feed of 1 inch per minute. Cutters 3/4 inch in diameter were used, and the cutting was done on the peripheral teeth; but not more than five castings were finished before the cutters had to be sharpened. After a number of trials, and various changes in the cleaning method without results, it was decided to grind the surfaces first. Accordingly, a grinder was arranged to grind away the outer surface or scale. Milling the surfaces after grinding was so much easier that one cutter now mills an average of more than thirty castings before it requires resharpening.

The part shown in Fig. 1 has a slot, 1 1/2 inches deep, that is milled in the recess between two risers. The material is gray iron, and the machine

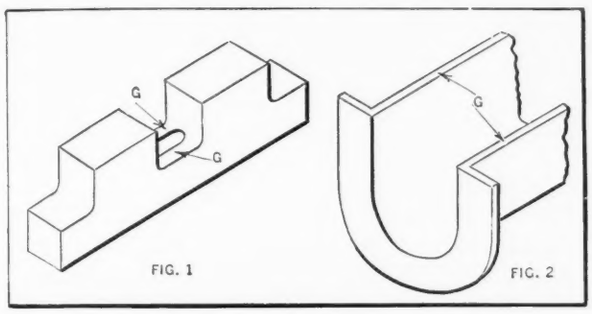


Fig. 1. Gray Iron Casting Required in Thousand Lots
Fig. 2. Gray Iron Part Made in Lots of One to Twenty

used was a Pratt & Whitney spline milling machine. With the castings either tumbled or sand-blasted, time was divided almost equally between cutting and changing cutters. Finally a grinding wheel of the proper composition and size was secured, and the surface marked *G* was ground free from sand and scale. The durability of the cutters with the present method shows that it paid to make the change. With the cutters running at 1700 revolutions per minute, 85 castings are now machined before it is necessary to resharpen them.

One end of a trough used in municipal water filtering plants is shown in Fig. 2. These troughs are about 14 inches wide across the top, of 1/2 inch section, and come to the shop in lengths of from 4 to 8 feet. The work consists of finishing the two upper edges marked *G*. This work is done on a planer equipped with a Farwell milling attachment, and the cutters used are 10 inches in diameter, with inserted teeth or blades. It was found that it was easier on the cutter to machine about 1/4 inch deeper than the lowest spot and to use a fast feed. In this way, the cutter was kept under the scale and broke out the scale ahead of it. It was thought that this would avoid striking the harder iron of the surface and any sand embedded in it, but occasionally a hard spot was encountered and the cutter was dulled. This necessitated a long

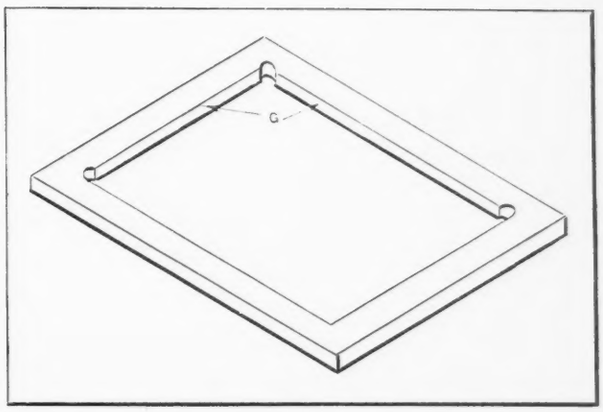


Fig. 3. Gray Iron Casting Required in Medium Quantities

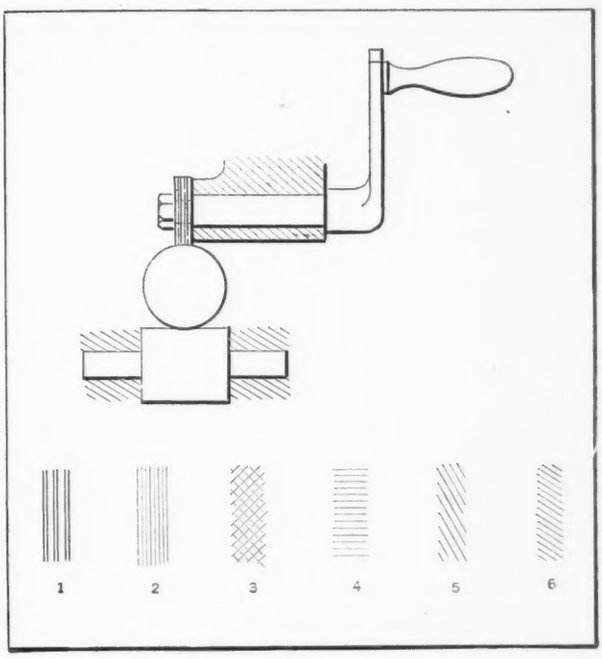
resharpening job, besides the dismounting and resetting of the cutter. By grinding the edges *G* with a portable grinder until the entire surface was made bright, there was no danger of dulling the cutters. The five or ten minutes spent with the portable grinder in this way saved hours spent in resharpening cutters.

A planning department will seldom countenance two operations on a job that can be performed in one, but when the work shows that a saving will be effected by a second operation, it is false economy to do without it.

Middletown, N. Y. · DONALD A. HAMPSON

IDENTIFICATION MARKS FOR STEEL

Making the mistake of getting the wrong rough bar from stock is often the source of considerable annoyance and loss. While it is possible to judge a piece of steel by sparks from a grinding wheel, it often happens that considerable labor is performed before a mistake is discovered. The painting of steel bars with various colors has its advantages, but there are times when the paint is rubbed off. It is a great mistake and nothing short of carelessness to receive a shipment of valuable steel



Hand-operated Rollers for Marking Steel

without immediately placing on it some distinguishing mark for identification.

The writer has seen a workman waste a lot of time trying to harden in oil a tool that was not made of oil hardening steel, and has seen another workman ruin a piece entirely in hardening what he thought was water-hardening steel. Cases too numerous to mention have resulted in time lost, simply because the proper precaution was not taken in the beginning.

The stock-room is not a dumping ground, but is the starting point of production, and should receive proper care and consideration. Upon the receipt of a shipment of steel, whether it be a bar or a carload, some dependable person should have it marked in a manner fitting every possible contingency. Whether the bars are round or flat, they could be run through a hand-operated roller, as shown diagrammatically in the accompanying illustration. There may be as many of these rollers as is considered necessary for safety. Sections 1 to 6, inclusive, in the illustration show distinguishing marks, which may be made by placing the proper roller on the spindle of the marker.

The bottom roller, obviously, should have a vertical adjustment to compensate for the various sizes of stock, and may be vee-grooved as desired. The impression should be made the entire length of the bar, so that no matter whether the piece cut off is 1/4 inch or 2 feet long, the identification mark will be visible, and no amount of rough handling will efface the marking. The tool-crib also should be supplied with hand stamps of the same marks. The stamps and the rolls should bear the name of the kind of steel represented.

It would be advantageous both to the steel manufacturer and the user to have the steel carry an identification mark when leaving the mill. Standardization of steel marks would be a step in progress.

Ontario, Cal. JOHN HOMEWOOD

GRINDING RADIUS ENDS OF SOLENOID PLUNGERS

In Fig. 1 is shown a 12- by 18-inch Cincinnati grinder equipped for grinding solenoid plungers to the required radius, as shown at *R*, Fig. 2. The plungers are clamped in a fixture *A*, Fig. 1, which

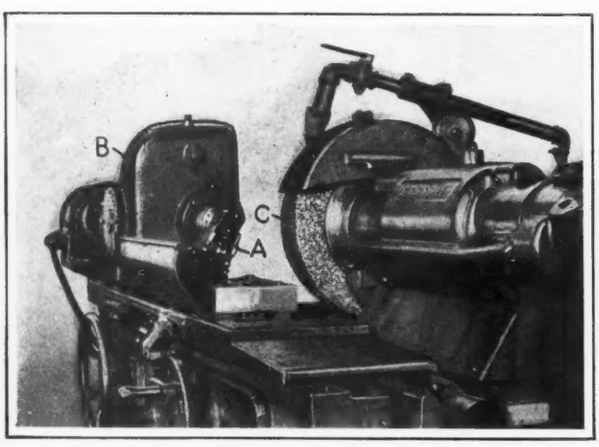


Fig. 1. Machine Equipped for Grinding Ends of Solenoid Plungers

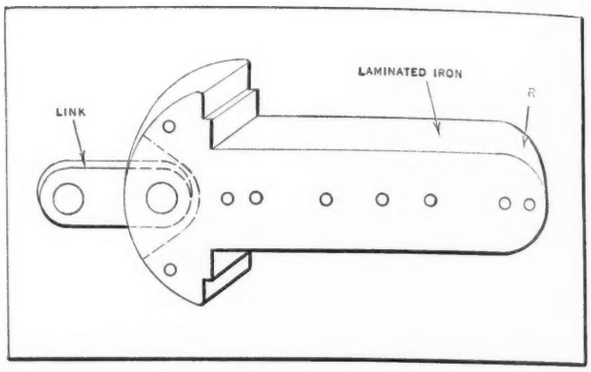


Fig. 2. Solenoid Plunger Ground to the Required Radius at R on Machine Shown in Fig. 1

is held in the spindle of a special oscillating attachment *B*, driven by a separate motor.

The emery wheel *C*, which has a diameter of 20 inches and a face 4 inches wide, is given a mechanical floating or longitudinal movement by means of a device installed on the wheel-spindle. The floating movement prevents clogging or loading of the wheel. This idea was suggested by the user of the machine and developed by the builders.

Previous to the development of the floating device, the oscillating movement was imparted to the plunger fixture by hand through a lever clamped to the regular headstock spindle. Two adjustable stops are provided for governing the strokes. Producing the required oscillating movement by hand was a laborious process, particularly as the traverse and cross-feed handles had to be operated simultaneously. The installation of the new equipment resulted in a 50 per cent increase in production.

This oscillating method can be adapted to numerous other cases where speed figures in mass production, and where the grinding of radii is limited by the capacity of the machine. The oscillating attachment, which is adjustable, has a maximum stroke of 180 degrees. U. J.

TRANSFERRING BLIND HOLES WITH WINDOW GLASS

A method of transferring blind holes that the writer believes to be original is described in the following. Several blind holes were required to be drilled in a number of metal cover pieces. It was necessary that the holes match those in a sample cover which could not be removed from the machine for marking purposes. To obtain a layout of the holes, the writer cut a piece of glass to correspond with the shape of the cover and placed this over the sample piece. The centers of the holes, which could be seen through the glass, were then marked on the upper surface of the glass with a pencil point dipped in Prussian blue.

A sheet-metal templet previously cut to the shape of the cover was then placed against a parallel bar and the glass located on the templet with its edge also against the parallel bar. The centers marked in Prussian blue were then transferred to the chalked upper surface of the metal templet by pressing down on the glass. The templet thus marked was drilled and used to locate the holes on the new covers.

Hamilton, Ontario, Canada W. KENDALL

Shop and Drafting-room Kinks

AUXILIARY CLAMP FOR TOOLPOST

In Fig. 1 is shown the body of an auxiliary clamp designed for use on a lathe toolpost. Its purpose is to hold the tool rigid and prevent it from slipping back below center, as sometimes happens in using a toolpost with a rocker seat. The method of applying the clamp is shown in Fig. 2. The upper end of the toolpost is threaded to fit the large threaded hole in the body of the clamp, and the clamping screw is placed in the small hole and tightened on the rear end of the tool held in the post.

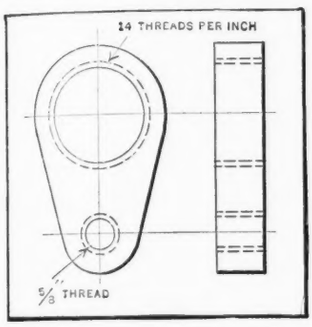


Fig. 1. Auxiliary Clamp for Toolpost

A number of these auxiliary clamps are in use at the shops of the Atchison, Topeka, and Santa Fé Railroad at San Bernardino, Cal., where they have been found very useful for heavy roughing out work. The dimensions of the clamp depend, of course, on the size of the lathe, the one here illustrated being applied to a 25-inch lathe.

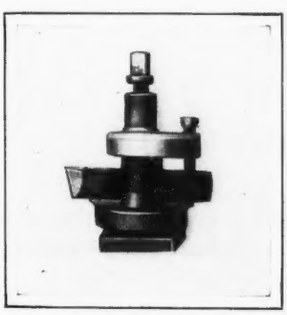


Fig. 2. Application of Clamp to Toolpost

San Bernardino, Cal. S. R. MEEK

SAVING DETAILING TIME

The practice in most drafting-rooms is to detail every part of an assembly except standard stock parts. One concern goes further than this in eliminating what it considers avoidable drawing work by making no detail drawing of simple parts, such as plain shafts, pins, keys, springs, etc., but simply writing a description of the part on the detail sheet. Besides these parts, shafts with two diameters, shafts with one key or spline, shafts with threaded portions, or shafts with drilled or tapped holes in the ends are also described in writing, and thereby the necessity of a drawing is avoided. The rule in this plant is that any part that may be described so that it is impossible to mistake the meaning, may be ordered in words alone.

New Haven, Conn. T. E. WELSH

REMOVING DENTS FROM THIN SHEETS

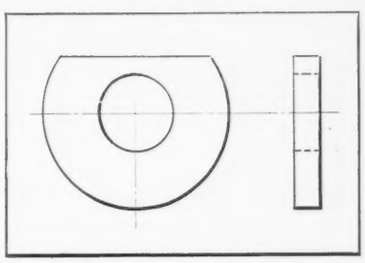
The writer noted with considerable interest the article in January MACHINERY, page 383, describing the use of pieces of old hardened water pump packing for removing dents from thin tin strips. The idea is very good, but has the disadvantage that the piece of pump packing must be moved about in advance of the hammer before each blow is struck. The packing also temporarily obscures the dents.

A rawhide hammer is a more practical tool, as it can be used directly on the metal. When a hammer of this kind is not available, however, a good substitute is an ordinary hammer with the end covered by a piece of rawhide. The rawhide may be secured by folding the sides up around the end of the hammer and fastening with wire twisted around the hammer head just below the handle.

Oaklyn, N. J. W. T. VAN HORN

WASHERS FOR DIE-FASTENING BOLTS

Insecure bolting sometimes results in the shifting or misalignment of punch press dies on the bolster plate. This may happen because the washers placed under the heads of the bolts have become deformed or bent out of shape. The slots in the die-shoe are usually made large, in order to allow for adjustment, and under these conditions, the washers are not thick enough to withstand the strain. This difficulty can be overcome by using thicker washers made from bar steel. For ordinary purposes, washers 1/4 inch thick made from 1 3/4- or 2-inch bar stock have been found satisfactory. The holes in the washers should be made 1/16 inch larger than the diameter of the bolts.



Washer for Die Bolts

In making a washer, the hole is drilled and the washer parted from the bar stock, after which its sides are faced parallel. Rough-finished faces are better than smooth surfaces, as their gripping power is greater. It is a good plan to make some of the washers with one edge cut away, as shown in the accompanying illustration, so that they can be used with bolts located close to a shoulder on the die-shoe.

Clinton, Iowa E. A. SISSON

SUPPORTING COLLARS FOR THIN SAWS

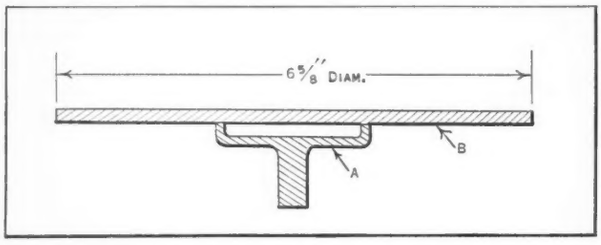
Thin milling saws, 6 inches or more in diameter, have a tendency to weave or twist sidewise when cutting sheet stock. This can be overcome by placing a suitable steel disk or collar on each side of the saw. The collars should be about 1 inch smaller in diameter than the saw. The stiffening effect of the collars prevents breakage, such as frequently occurs when a dull unsupported saw begins to cut to one side. Better work will also result from the use of the supporting collars.

Syracuse, N. Y. H. L. WHEELER

Questions and Answers

SOLDERING CAST-IRON FLANGES TO BRASS PLATES

M. K.—In the manufacture of certain parts for our products, we have occasion to solder cast-brass flanges, such as shown at *A* in the accompanying diagram, to brass plates or disks *B*. We are interested to know whether the joint would be equally strong if we were to solder tinned cast-iron flanges to the brass plates.



Flange and Disk to be Joined by Soldering

Answered by A. Eyles

The strength of soldered joints between cast-iron and brass surfaces is very uncertain, and at best, considerably less than when the parts soldered together are both of brass. Miscroscopical examination of soldered joints has shown a certain amount of interpenetration between tinned cast iron and brass, but in a properly "soft-soldered" brass joint, the extent of the interpenetration has been observed to be approximately twice as great. This proves that solder has a much greater "affinity" for brass than it has for cast iron, although the latter may be effectively tinned.

Cast iron can be soldered, and not infrequently broken cast-iron parts can be repaired quite satisfactorily by soldering. It is often desirable to solder cast iron when altering cast-iron foundry patterns. For this purpose, soft soldering gives all the strength necessary.

The tinning of the surface of cast iron preparatory to soldering is an important and difficult operation. First the cast-iron surface must be perfectly clean. A dilute sulphuric acid bath is the most common pickling solution for cast iron. The acid percentage varies from 10 to 25 per cent. Another good formula is 5 per cent each of sulphuric acid and hydrofluoric acid, with 90 per cent of water. This should be separately diluted before adding it to the bath. After pickling, the cast-iron flanges should be washed in hot water, followed by immersion in an alkaline solution, to neutralize any remaining traces of acid.

If the tinning bath is not quite ready, the cleansed castings may be preserved from oxidation for some time by immersion in a very weak hydrochloric acid solution. As soon as the tinning vessel is ready, the castings should be immersed in a bath of zinc chloride, and finally in molten tin, or other tinning alloy. The latter usually consists of varying percentages of tin and lead with a very small percentage—less than 0.75 per cent—of antimony.

On the molten tinning metal a small quantity of zinc chloride and some salammoniac is poured, so that the surface is covered to a depth of about 1/4 inch. This prevents oxidation. The metal should be maintained just above the melting point, as undue heating will spoil the appearance of the cast-iron flanges and accelerate the formation of dross or slag. After the castings have been thoroughly tinned, they should be well shaken to remove superfluous metal, withdrawn, and washed in clean hot water. The castings can be subsequently dried by rubbing with fine, clean, warm sawdust. When the cast-iron flanges are properly tinned, they can be soldered to the brass plates in the usual way, using ordinary solder consisting of 50 per cent tin and 50 per cent lead. However, solder containing 70 per cent tin and 30 per cent lead is preferable. The strongest joint is obtained when the parts are closely fitted together during the soldering operation.

MEASURING TAPER GAGE

C. E.—A taper gage with beveled sides, as shown in Fig. 1, is required. What is the most practical and convenient method of checking or inspecting the accuracy of this gage? A method that can be used in the ordinary tool-room or inspection department, under everyday practical conditions, is required.

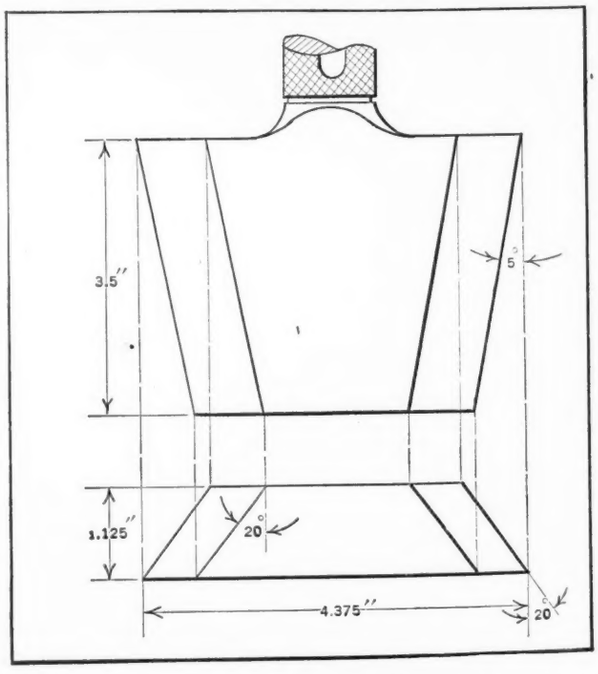


Fig. 1. Taper Gage to be Inspected

Answered by E. B. Payson, Assistant Superintendent, Bryden-Neverslip Co., Catasauqua, Pa.

The accuracy of the taper gage, when finished, can be checked with a protractor and micrometer. With these instruments, the gage can be checked

quite accurately after it is hardened and ground. However, every gage that is used to any extent is subject to wear, and should have a master gage by which it can be checked occasionally. The master gage should be provided with means for showing when the wear has reached the stage when a new gage is needed.

In Fig. 2 is shown an easily constructed master gage for testing the taper gage shown in Fig. 1. The parts *A* and *B* should be machined, hardened,

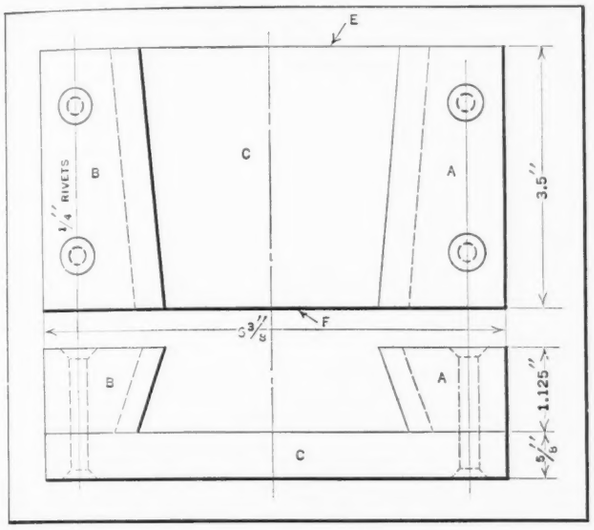


Fig. 2. Master Gage for Checking Gage Shown in Fig. 1

and ground to the correct taper. It is only necessary to grind the tapered side and the side located on the base *C*. The rivet holes should, of course, be drilled before hardening the tapered pieces. The length of the pieces should be 3 9/16 inches. The base *C* is accurately machined, but is not hardened. The tapered members are assembled on base *C*, using the finished gage shown in Fig. 1 to locate the parts. Parts *A* and *B* should be so positioned, when clamped in place, that the plug gage, which is 3.5 inches high, lacks 1/32 inch of being flush with either end of parts *A* and *B*. Part *C* is then drilled, hardened, and ground, after which the three members that constitute the complete gage are riveted together.

After being completely assembled, the end surfaces *E* and *F* are ground down until they are flush with the end surfaces of the taper gage when it is properly positioned in the master gage. Any wear on the taper gage can be easily detected, as it will permit the gage to project beyond the ground surface *F*. If a maximum and minimum limit master gage is desired, the 3.5-inch dimension must be increased, so that when the plug gage is flush with surface *E*, the opposite end will still lack a certain amount of being flush with the surface *F*, depending upon the tolerance allowed.

OIL FOR TIN FLOWING

N. B. I.—I want to find out how a metal product, consisting of several tin parts, may be dipped in hot oil, so that the tin will flow and fill up all cracks and seams. What kind of oil is used, and what temperature must it be heated to? Should the parts be dipped in a cleansing solution prior to the oil dip? How are the parts cleaned after the oil dip?

Answered by R. S. Drysdale, Chief Cutting Oil Engineer, Sun Oil Co., Philadelphia, Pa.

From experience we have found that a non-volatile oil of high flash and heavy body is required for the flowing of tin. This oil should be blended with 10 per cent of deodorized sperm oil. The oil bath should be kept at a temperature of 440 to 450 degrees F. Parts should be suspended in the oil and then rinsed in a mild soda bath of approximately 160 to 180 degrees F. The addition of sperm oil to the mineral oil will allow the mixture to emulsify readily in the presence of a mild soda ash solution, and if the soda bath is kept at the correct temperature, the evaporation will be rapid enough so that no rust will appear on the metal parts.

Lard oil or animal red oil could be used in place of the sperm oil, but being on the acid side, such oil will require a greater percentage of alkali in the wash for emulsification purposes, and this excess alkali is likely to darken or spot the tin. If the correct mineral oil is used, there is little loss due to evaporation, and the oil will not thicken to any great extent after long usage. If the parts are dirty, they should be dipped in a cleansing solution prior to the oil dip, although this is not absolutely necessary.

ANGLE FOR DOVETAIL MACHINE SLIDES

L. R. S.—Is there any recognized standard angle or system of angles for the dovetails of machine slides?

Answered by Forrest E. Cardullo, Cincinnati, Ohio

There appears to be no standard angle for dovetail machine slides, but the angles most commonly used range from 60 to 45 degrees. The wedging action of a dovetail slide tends to open the sides under stress. In this respect, the effective force is greater in the case of a 60-degree than in the case of a 45-degree dovetail, the forces being in the ratio of about 173 to 100. The 60-degree slide, however, is easier to machine and fit accurately, and hence is preferred by the majority of manufacturers.

A 45-degree slide, when properly designed, requires a wider space than a 60-degree slide of the same capacity. As the width available for the slide is limited in the case of some machines, the 60-degree angle is naturally the one employed. It is the writer's opinion that, within given limits, a stronger slide can be designed having an angle of 60 degrees than one having an angle of 45 degrees, in spite of the fact that, with a given load, the tendency to force the sides apart by the wedging action is somewhat greater in the case of the 60-degree angle.

* * *

NEW ELECTRICAL JOURNAL

A new journal in the electrical manufacturing field, known as *Electrical Manufacturing*, has recently made its appearance. The publication will be devoted to production, marketing, administration, and servicing problems in the electrical manufacturing field. It is published by the Gage Publishing Co., Inc., 461 Eighth Ave., New York City, with Stanley A. Dennis as editor.

EXAMPLES OF MODERN GRINDING PRACTICE

The accompanying illustrations show some examples of modern wide-wheel grinding, two-wheel grinding, and grinding with stepped wheels, the operations being performed on equipment built by the Norton Co., Worcester, Mass. Fig. 1 shows the grinding of ball-bearing rings, mounted six at a time on an arbor and ground with a wide wheel at a production rate of 41 rings per hour.

Fig. 2 shows an example of two-wheel grinding. The work is a steering knuckle which is ground with a tolerance of 0.0005 inch on two diameters simultaneously, the production being 180 knuckles per hour.

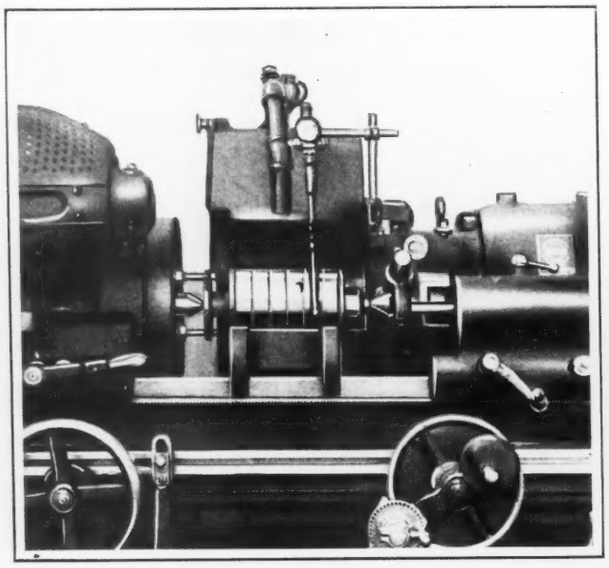


Fig. 1. Grinding Six Ball Bearing Races at Once with a Wide Wheel

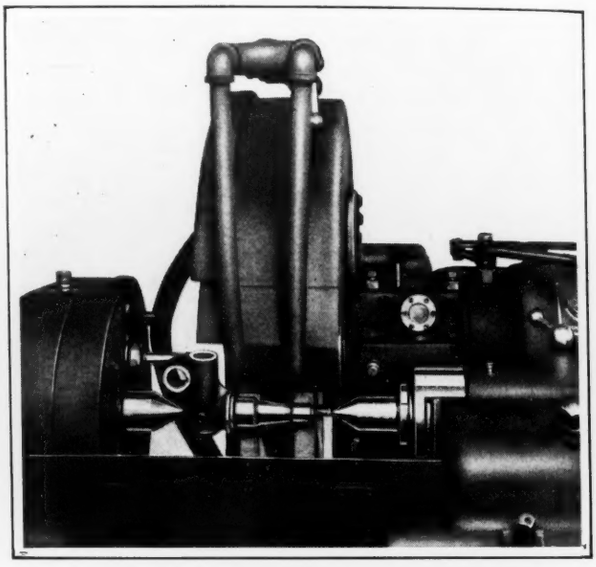


Fig. 2. Grinding Two Diameters at the Same Time with Two Wheels

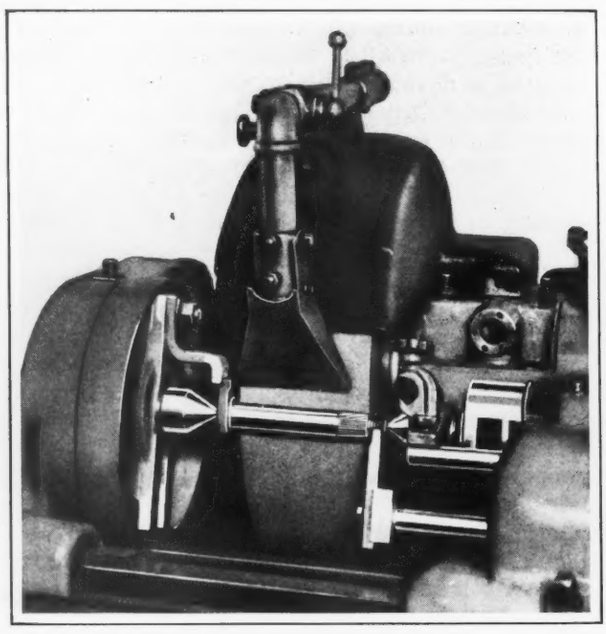


Fig. 3. Grinding an Automobile Steering Arm with a Wide Wheel

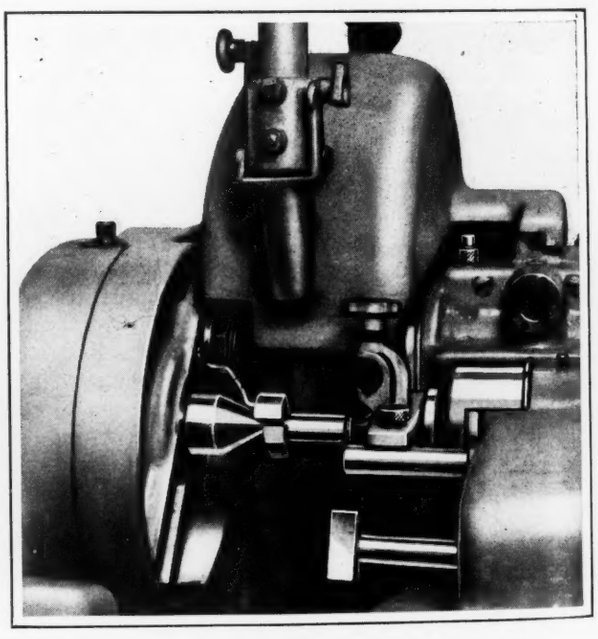


Fig. 4. Grinding Two Diameters at Once with a Stepped Wheel

Fig. 3 shows the grinding of an automobile steering arm with a wide wheel, the production rate being 100 pieces per hour. Fig. 4 shows a shock absorber part being ground by means of a stepped wheel, the production being 120 pieces per hour, finished on two diameters, and including two operations, one roughing and one finishing, with a tolerance of 0.0005 inch.

* * *

WORLD ENGINEERING CONGRESS

The World Engineering Congress, which will be held in Japan in the fall of 1929, will open October 29, 1929 and extend throughout the month of November. A number of inspection trips have been planned for those who wish to see the industrial developments of Japan and Southern Manchuria. The scope of the technical program embraces every phase of industrial and scientific development and is essentially international in character. Those wishing further information about the Congress should communicate with the American Committee of the World Engineering Congress, 29 W. 39th St., New York City.

DRAWING SIZE STANDARDS

By GEORGE M. MEYNCKE, Engineer,
The Globe-Wernicke Co., Cincinnati, Ohio

The drafting-room has been overlooked in the work of standardization. It is doubtful if a wider variety of sizes exist than those used in making the records of engineers. The chaos begins with the nomenclature, because maps, plans, and drawings are essentially the same thing. They are the sign language of engineers—the engineer's mode of expressing and recording his work. The mechanical engineer uses the word "drawings" to describe his records, the civil engineer calls them "maps" and the structural engineer calls them "plans."

There is such a wide variation in the size of the objects designed that it would be impractical to attempt to standardize a single sheet size, as can be done with the correspondence sheet. However, there can be no disadvantage in adopting a standard series of large sheet sizes and in using the standard series for maps, plans, and drawings.

The ratio of engineers to mechanics in the manufacturing industry is increasing. The use of drawings for reference by executives and the exchange of drawings between concerns is increasing. Drawings are awkward sheets, and the advantages to be derived by the users of large sheets from the adoption of a series of standards are tantamount to the standardization of correspondence or catalogue sizes. Practically all large manufacturers maintain a series of drawing sizes, but only a small percentage use a known standard.

There are three series that are used frequently enough to be called a known standard. The most extensively used series is known in some localities as the A.S.M.E. Standard, although the name is not universally known and these sizes have not been officially recognized by the American Society of Mechanical Engineers. The sheet dimensions of the series are 9 by 12; 12 by 18; 18 by 24; 24 by 36; and 36 by 48 inches. These so-called A.S.M.E. sizes are extensively used by machine tool and small tool manufacturers; in fact, these industries have come nearer to adopting a standard than any other in the mechanical field. There are almost no standards in the civil and structural engineering fields. Many concerns follow the dimensions of the series given above, in general, but depart from the standard in one or two sizes.

Another series of sizes known as the "Five Factors" are also used in the mechanical field. The sheet dimensions of this series are 10 by 15; 15 by 20; 20 by 30; and 30 by 40 inches.

A third series known as "Letter Head Multiples" are occasionally used in the mechanical field, but are more extensively used in civil engineering. The sheet sizes are 8 1/2 by 11; 11 by 17; 17 by 22; and 22 by 34 inches. As the name indicates, these sizes are multiples of the 8 1/2 by 11 letter size. The purpose of the dimensions is to produce sizes that will fold to standard letter size, and thus can easily be sent out with corespondence. Some concerns who do not use the 8 1/2 by 11 letter size, use a series of multiples of their odd letter sizes.

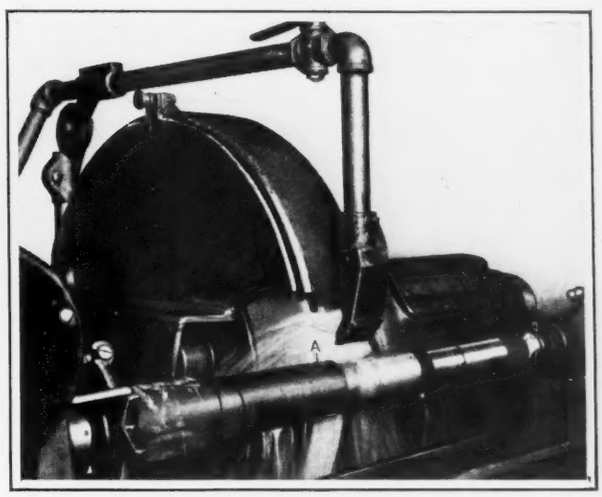
Standard drawing sizes will eliminate many sizes of filing equipment and improve the accessibility of existing files. It will reduce the number of widths of drawing and blueprint paper. It will also make possible the purchase of standard sheets cut to size and thus save time and prevent waste in the drawing-room. The standardization must originate with manufacturing concerns, because they create the demand for drawing material and equipment.

* * *

GRINDING SPINDLES BY PLUNGE-CUT AND TRAVERSE METHOD

By HOWARD ROWLAND

All diameters or sections of the milling machine spindle shown at *A* in the accompanying illustration are ground by the combination of a plunge cut and a traverse cut. The machine used is a Cincinnati 12- by 72-inch self-contained grinder. The illustration shows the work undergoing the second grinding operation. The wheel is fed to within 0.001 to 0.0015 inch of the required size, using the



Grinding a Milling Machine Spindle by Plunge-cut and Traverse Method

plunge-cut method and making as many plunges as may be required to cover each section with the 3-inch face of the grinding wheel.

On the last plunge required for each section, the wheel is fed to the stop, and the traverse movement used to straighten and bring the cut to size. Usually two or three traverses by hand at a rate of approximately 48 inches per minute are required. The wheel used for this work is a 36- inch diameter by 12-inch hole aloxite 50N, which gives satisfactory service. The heavy supply of grinding compound is kept flowing over the wheel during the grinding operation, as shown in the illustration. The time per piece is 30.7 minutes.

* * *

Some figures on the life of pneumatic tires in bus service were recently given in a paper read before the Institute of Transport in England by L. G. Wyndhamshire, chief engineer of the Birmingham & Midlands Motor Omnibus Co., Ltd. The figures related to tires on buses having a front axle load of 5100 pounds and a rear axle load up to 9000 pounds. Single 6-inch tires were fitted to the front wheels and single 8-inch tires to the rear wheels. Out of a total of 7800 tires, those used on the front wheels averaged 25,000 miles, and those on the rear wheels, 17,000 miles.

Progress in Machining Manganese Steel

By A. S. MARTIN, Engineering Department, Firth-Sterling Steel Co., McKeesport, Pa.

THE turning and boring of manganese steel by the use of a new type of high-speed steel developed by the Firth-Sterling Steel Co., McKeesport, Pa., were described in an article published in March MACHINERY. This new cutting medium has since been employed for various other machining operations on manganese steel, such as drilling, keyway-cutting, and shaping. Typical examples of what is now being accomplished in the way of machining cast and rolled manganese steel will be described in this article. The proper tool angles, feeds, and speeds necessary to produce the most satisfactory results in each particular operation were determined by means of experiments.

Shape of Drill Points for Manganese Steel

For the successful drilling of manganese steel, it seems necessary to modify both the drill-point angle and the cutting-edge angle of the standard type of twist drill. First, the drill-point angle should be reduced to a minimum of 15 degrees, as illustrated at *A*, Fig. 1. Capable drilling machine operators can quickly determine the exact angle that results in maximum production. Experience may establish the fact that the drill-point angle should be varied with different drill diameters so as to regulate the drilling pressure. This reduction of the drill-point angle results in a curved cutting edge, as indicated by arrows *X* at *B*, and a sharp cutting angle, as shown by arrow *Y*.

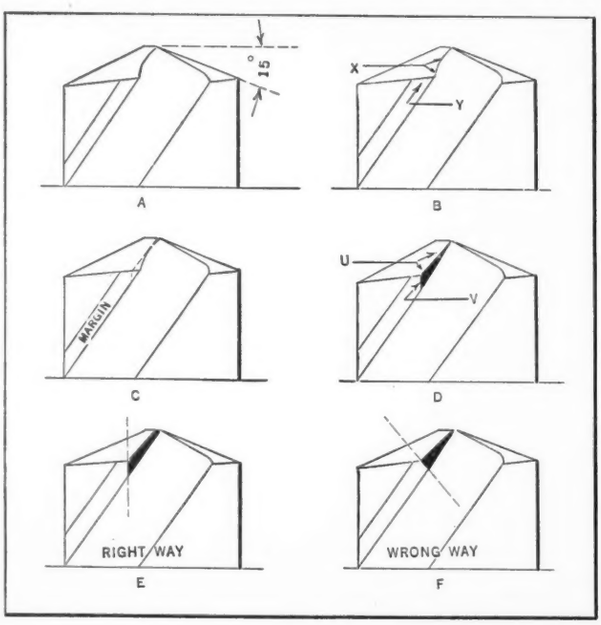


Fig. 1. Diagrams Showing the Modification of Drill Points for Drilling Manganese Steel

Second, the cutting edge should be blunted, as is usually done for drilling brass, by grinding up to the dotted lines in diagram *C*, about half way back on the margin. This will straighten out the cutting edge, as indicated by arrows *U* in diagram *D*, and will also reduce the cutting angle so that it is almost square, as shown by arrow *V*. Care should be taken to so grind the drill that the blunted face makes an acute cutting angle of slightly less than 90 degrees, as indicated by the dotted line in diagram *E*. If the blunted face makes an angle of more than 90 degrees, as shown by the dotted line in diagram *F*, it will prevent the drill from cutting.

The flattening or dulling of the cutting edge is important, as it gives a solid support to this edge. The drill may then be likened to a lathe tool having little clearance. A very light feed is used in drilling manganese steel, and so the drill should be given a small lip clearance. The drill should be short and used in a heavy rigid machine. For safety, the work should be clamped firmly to the table. It is the practice to do all drilling without using a lubricant.

With a 1-inch diameter drill, speeds of from 40 to 80 revolutions per minute are satisfactory, using a fine feed of from 0.002 to 0.005 inch per revolution. If the feed is too heavy, failure occurs at the cutting edge, and if the speed is too high, the corners of the drill fail. If the drill cuts properly, it will produce a dark purple continuous curling chip from each flute; however, if the feed is too heavy, the drill will chatter and produce finely splintered chips.

There seems to be little difference between the drilling of cast and rolled manganese steel. However, rolled manganese steel appears to be more homogeneous, whereas in castings, sand inclusions and blow-holes are frequently encountered, which have a tendency to reduce the number of holes that can be drilled per grind of the tool. Also, "marbles" (undissolved ferro-manganese) are occasionally encountered in castings, and these have a detrimental effect on the drills.

The fact that the new high-speed steel enables keyways to be cut in manganese steel is of particular interest to manufacturers, as it eliminates the need of mild-steel inserts or cores in cast manganese gears and wheels. Not only is a stronger part produced by cutting a keyway directly in the manganese steel, instead of in a mild-steel insert, but the method also eliminates breakage of the casting itself, which frequently occurs when mild-steel cores are used, owing to the excessive shrinkage of manganese steel castings in cooling.

Cutting Keyways in Manganese Steel

In cutting keyways, it was found necessary to provide an outboard support for either the cutting tool or the cutter-bar, so as to insure sufficient rigidity to the cutting edge of the tool to prevent its deflection from the work. Various types of key-seating machines have such an outboard support and are amply rigid to machine accurate square-

cornered keyways in manganese steel. The production time on this work is limited almost entirely by the rigidity and capacity of the machine itself.

The cutting speed in machining keyways should not exceed 15 feet per minute. It is the practice first to rough out the keyway with a cutting tool having well rounded corners, and then, in a second operation, to remove the fillet produced by the rounded corners of the tool, with a second cutter having clean sharp corners. The tools are given just enough clearance to prevent rubbing on the work. Each stroke of the tool produces a single dark purple-colored chip. The work is clamped securely to the table to prevent slippage under the pressure of the tool.

Fig. 2 shows a keyway-cutting operation in progress, while Fig. 3 shows a finished gear having four keyways with clean sharp corners.

Shaping, Planing and Boring Operations on Manganese Steel

Shaping and planing of manganese steel are almost entirely a matter of obtaining sufficient machine and tool rigidity to prevent the cutting edge of the tool from springing away from the work at the instant that the tool comes in contact with the work. A slow cutting speed is used in such operations—not over 15 feet per minute. Any depth of cut within the capacity of the machine may be taken, using light feeds.

In boring operations on manganese steel parts, it is the practice to chuck the work firmly and use the largest possible boring-bar. A roughing cut is taken deep enough to "clean up" under the lowest spot, so as to prevent rubbing of the tool on scale. A cutting speed of from 12 to 15 feet per minute is suitable, with a light feed of about 1/64 inch. In taking finishing cuts, an unusually fine cut is possible, so that work can be machined within limits of plus or minus 0.002 inch.

Squaring up of the hub face is advisable before commencing a boring operation. It is also desirable to burn off the gate of the casting farther back than usual if boring and facing are to be done, so as to minimize the hard spot which a gate causes. When the bore is to have a sharp square shoulder, the fillet made by the roughing tool is machined out in a separate operation with a sharp-cornered tool. This tool is set in the center of the work, and no lubricant is used.

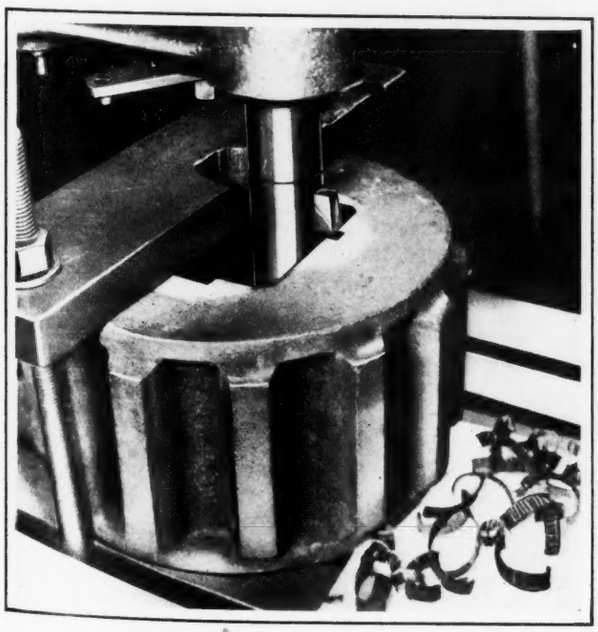


Fig. 2. Cutting a Keyway in a Cast Manganese Steel Gear

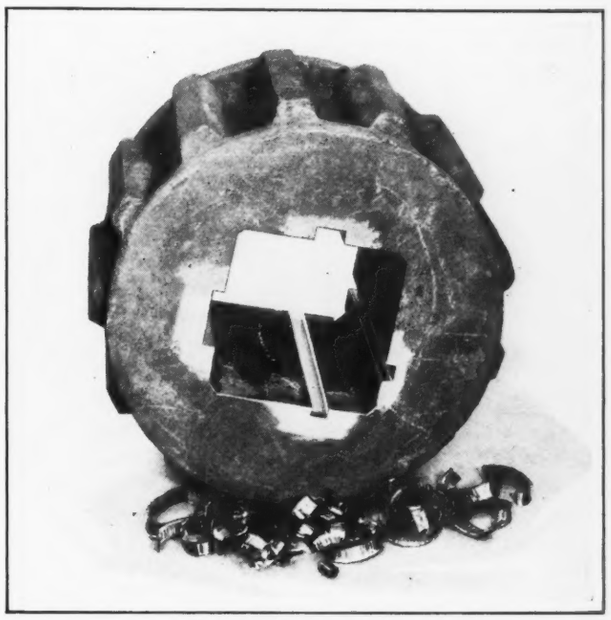


Fig. 3. Manganese Steel Gear with Four Keyways Cut in the Solid Metal

Angles and Shape of Tools

Tools for machining manganese steel should have a clearance angle of about 6 degrees and enough rake to curl the chip. The nose of the tool may be of any standard type, with the corners rounded to a radius of 1/16 inch on small tools and 1/4 inch on large tools. If a sharp square corner is required on the work, a pointed tool should always be employed for squaring up the fillet only.

* * *

TESTS ON ALLOYS FOR DIE-CASTINGS

A comprehensive series of tests on both aluminum-base and zinc-base die-castings is being carried on by a committee on die-casting metals and alloys of the American Society for Testing Materials (1315 Spruce St., Philadelphia, Pa.) While the die-casting process has been developed to remarkable proportions during the last twenty years, there is still a lack of dependable information on the properties of alloys suitable for die-castings. The tests have been carried out on a most elaborate scale, and the aluminum-base alloy test program alone has involved the testing of 50,000 specimens. About one-half as many zinc-base specimens will be tested.

Both producers and consumers of die-castings have contributed materials and services on a large scale in the carrying out of these tests. Standard specimens and standard methods of tests were adopted to enable a number of cooperating laboratories to obtain comparable results on similar specimens. The tests cover strength, hardness, brittleness, and corrosion resistance.

What MACHINERY'S Readers Think

Brief Contributions of General Interest are Solicited and Paid for

A COMMENT ON ENGINE LATHE DESIGN

Referring to the article "A Comment on Engine Lathe Design," on page 674 of May MACHINERY, another improvement in engine lathe design that might be suggested is to provide a lever, handwheel, or other means for turning the spindle of a lathe by hand. This is a necessary feature in placing chucks and other heavy fixtures in the machine. Most modern makes of geared-head engine lathes are so constructed that there is no way of turning the spindle by hand.

Even in the smaller machines, chucks and faceplates are heavy pieces to handle; and when a crane is used to hold the chuck until the first thread is caught, provision must be made for turning the chuck to accomplish this purpose. This is somewhat difficult to do. I have seen many workmen on 12- or 14-inch machines of this kind holding the chuck while giving the necessary turning motion so as to catch the first thread, and I know from personal experience that this is a very tiresome performance. A handwheel or a lever, attached to the machine, for turning the spindle would remove the strain on the operator. This work can be done with comparative ease on the old belt-driven machines.

A TOOLMAKER

MACHINE TOOL PRICES

I concur with the writer of the article on page 710 of May MACHINERY, "Are Machine Tool Prices Really High?" I believe I am in full accord with all who have intelligently studied the subject. Prices are too low, considering the service rendered; a remedy remains still to be found, however.

It may be a far cry from the retail grocery business to the machine tool industry, but let us consider the former for a moment. Carrying on their business with charge accounts, making deliveries of all purchases no matter how small, and offering "service" of all kinds seriously threatened this entire business a few years ago. Then came a few hardy pioneers who had the courage to announce a cash-and-carry basis of doing business. Their prices were naturally lower, and when they developed into chain stores, it was believed that the independent grocer was doomed. By emphasizing service, however, in contrast with the frank lack of it in the chain stores, the independent grocer is still doing business, charging slightly more for his goods; and those who value service, willingly pay a few cents more per item.

Why would it not be possible in the machine tool field for a few manufacturers to come out and sell machines cheaper on a strictly cash basis, the transaction to be closed when the machine has been turned over to a transportation company for delivery? The only claim the purchaser would be entitled to would be for an actual flaw in workmanship or materials, the burden of the proof resting on him. Such manufacturers could sell their product cheaper than those who render free service, and could supply the needs of buyers to whom low price is the main consideration, without the low price meaning in any way an inferior product. To those who demand service, this would reveal that service costs money and is worthy of its price. This may sound revolutionary as a distribution policy, but it is not half as radical as the engineering changes that have taken place in the products of the machine tool industry in the last twenty years.

J. L. STARR

WHEN PURCHASING DEPARTMENTS LEAN OVER BACKWARD

The article on purchasing departments, page 673, May MACHINERY, prompts the comment that the tendency of the purchasing department to use its own judgment may have been worn down by a "statistical type" of management. I have in mind a purchasing department that refers the bids on engineering material or equipment to the proper shop department for comment. If it is desirable to accept any but the lowest bidder, the purchasing department must fortify itself with a long summary of reasons, expressed in non-technical language, in order to be able to explain when someone higher up may want to know why the lowest bidder had not been awarded the business. It is this method of "statistical management," as I term it, which weakens the morale of the purchasing department, so that after a while, the lowest price is always considered the best price, and all other conditions are ignored.

This type of management often falls into the error of taking the drawings of some special equipment accompanying a bid, which have been developed at great expense by a manufacturer, and inviting bids from other builders on the equipment shown in the drawings. These other builders, having no responsibility for the design, and taking the job only as so much machine work in accordance with drawings, can and do underbid the manufacturer who supplied the design with his bid. Sometimes the lowest bidder is not able to build a satisfactory product, even after being supplied with the design and the drawings, and it is only when the equipment is put into operation, that it becomes evident that the lowest price is not always the best price.

FREDERIC JEWETT

ARE SERVICE REQUIREMENTS EXCESSIVE?

I agree with what is said on the subject of service requirements on page 575 of April MACHINERY. When a very large and costly machine is purchased it is, of course, good policy to have an experienced man set up the machine and instruct the man in charge of the department, as well as the man who is to operate the machine.

I have myself used the following method: Whenever a new machine is purchased, we arrange to have a machine repair man thoroughly instructed in the operation of the machine when it is installed. Then if something goes wrong, this man is in a position to find the defect, which is a good deal better than to put a repair man not familiar with the machine on this work.

I find that, in a great many cases, buyers of machinery are very unreasonable in their requests for service. I also believe that there is too much haggling over the first cost of machines. In buying a machine tool, the first cost is not the main factor. The return on the investment is what counts. The question put to the machine tool builder should not be "What will it cost us?" but "What returns would we be likely to get on the investment?" That is the only sensible question to ask, whether the machinery bought is used in the making of safety pins or locomotives. First cost means very little; the return on the investment means everything.

PAUL LINDNER

SQUARE PEGS IN ROUND HOLES

Many a man in the shop is in the wrong job, struggling hard to give satisfaction in order to keep it. Such men are considered mediocre workers, although in some other branch of the industry they might be quite successful.

Generally, when a man does not show any ability in a particular line of work in the shop, it would be well to try him out on some other work, as it is possible that he will do much better in another department. Some of the large shops in the country are practising this method. No one is fired outright for inefficiency, but is tried out on different jobs until one is found that he is able to do well. Sometimes this work may be considered of a higher character than the work on which he failed. Apprentices who have done very poorly in the shop, on manual tasks, have sometimes proved to be unusually intelligent and capable in the drafting-room, and become first-class designers.

Mediocre men should be given the same opportunity to be tried out in different departments as those who are obviously unsuited to some line of work. It is possible that a man who shows mediocre ability only, in one department, may prove to be a real asset in another. Usually a man is mediocre not because he is dull or mentally deficient, but because the job does not fit his mental and physical characteristics. It is not the right job for him. He is a square peg in a round hole. It is a paying proposition for the employer to try to find the right place for him, as he will be much more valuable there.

W. J. HISCOX

KEEPING SALESMEN WAITING

A salesman spends about four hours out of every twenty-four in actual sales work. The other twenty hours are divided between rest, traveling, and "waiting." He travels by night as much as possible, to make the best use of his time.

When a salesman buys a railroad ticket, he is making an investment. He believes that the Blank Mfg. Co. is ready to place an order. His investment may run about $20 per day. Since he has but four hours of actual sales time available, his investment is $5 an hour. The salesman is matching cash against the business he expects to get. It is, therefore, discouraging when he is forced to sit and wait to see the purchasing agent, perhaps for hours at a time. He may have been riding on the train half the night so as to make an early call. With prompt action, he could conclude his business and take the next and only train out of town, but the delay causes him to miss the train, and lose a day.

It is true that the purchasing agent might see the salesman immediately, but would not place an order. Even so, he has saved the salesman and the concern he represents some time. On the other hand, the salesman who waits an hour or more and then receives an order for a small amount may not cover, with the profit of that sale, anywhere near the cost of the time that has been lost.

The four hours available to the salesman must be high-pressure hours. Every minute must be used for presenting sales arguments; otherwise, a low sales expense cannot be maintained. A low sales expense means a lower cost of the articles bought by the consumer. Lower cost means lower price, which, in turn, means more sales and more production; so there is a long chain of benefits to be obtained by eliminating the waiting periods in a salesman's time.

C. CHESTER MARK

NOISE IN MODERN INDUSTRY

Until the critical ear of the automobile buying public forced the automobile manufacturers to make cars that are practically noiseless, not very much thought was given to the subject of noise in manufacturing plants. The persistent demand for quietness in automobiles has had its effect upon the automobile manufacturer and also upon the machine tool manufacturer.

Time study men are beginning to consider seriously the effect of noise upon the efficiency of machine operators. Curves plotted to indicate the efficiency of different machine operators over a day's time fall off more rapidly for men in noisy departments than for those in comparatively quiet departments. Shop fatigue has long been an influencing factor in plant lay-out, and equipment design; now the noise problem is presenting new and various difficulties. Practically every automobile manufacturer has installed "quiet rooms," where inspectors pass on the relative quietness of operation of various units, and some anti-friction bearing manufacturers have installed electrical noise testing equipment; but while much effort has been expended toward noise reduction in a general way, no concerted effort has been brought to bear upon this all-important subject.

Gears are generally considered to be the worst offenders; however, the production of perfect gears, alone, would not eliminate all the noise from any piece of machinery, since the vibrations set up by even perfect gears would be amplified and propagated as noise, by the gear housings. Besides gears, there are many associated parts that cause a great amount of noise. So far, these parts have received scarcely any attention, when considered as noise producers.

E. J. VON DER HEIDE

STANDARD TAPERS FOR TOOL SHANKS

From a careful reading of the different articles on taper shanks and from the discussion at the meeting of the Sectional Committee on the Standardization of Small Tools and Machine Tool Elements at Pittsburgh, it appears that only two reasons are given for adopting different tapers for drills and other small tools than those now in use.

One reason given is that the present tapers are not quite uniform in taper, as precise measuring tools were not available at the time of the adoption of the 5/8-inch per foot taper—the Morse taper. As each number of taper is a complete unit in itself, and as one taper is not affected by the taper of other sizes, this does not appear a good reason for changing the present tapers.

The other reason given is that sometimes the 5/8-inch taper sticks in the hole while a 3/4-inch taper would not; on the other hand, evidence shows there is more difficulty in holding the 3/4-inch taper in place than there is from the 5/8-inch taper sticking.

Millions of these taper shanks are made right along and many millions are in stock or in use; therefore, it would seem very unwise to make any change in the existing taper for these tools, but rather to permanently adopt the Morse tapers as standard for drills and similar tools.

W. S. DAVENPORT

The writer suggests that the standard that would be most advantageous to adopt would be the 3/4-inch taper per foot. From a study which I made of the present tapers used, I find that they range from 1/2 to 3/4 inch per foot. If the 3/4 taper is adopted as standard, the holes with smaller tapers (less than 3/4 inch per foot) in spindles and other machine parts could be reamed to take this taper. The value of adopting a standard taper is beyond question. It reduces the variety of tools that need be carried in stock and all tools would be interchangeable.

A. DAVIDSON

I believe that if a standard taper is adopted, the Jarno taper would be ideal for all purposes. Its dimensions are easy to remember, as the number of the taper designates the size. It has a uniform taper per foot for all sizes. Calculations can be quickly and easily made, and this reduces possible errors. It is possible to extend the system to taper pin sizes. This would give a complete system of tapers that would cover every need.

I believe that the proposed taper of 3/4 inch per foot would be too steep for taper sockets, and that the high speeds now used would tend to loosen the taper shanks of drills, milling cutters and other taper shank tools.

It would be more economical to adopt a taper that has been in use for many years than to create an entirely new system of tapers.

H. L. WHEELER

If it is found impossible to agree on any of the now generally used standard tapers, a compromise should be made on the use of Jarno tapers, rather than on the 3/4-inch taper per foot. The Jarno taper is as practical as the proposed new 3/4-inch taper per foot and is now giving satisfactory service on many machines. Its selection would simplify matters considerably and would certainly be cheaper and less troublesome than an attempt to introduce a taper totally different from any of those now generally used.

H. C. KLINE

PROVIDING CHAIRS FOR WORKMEN

In May MACHINERY, page 672, a writer states that men working on boring mills, lathes, or milling machines need not stand up between set-ups, as they can watch the tool just as well sitting down. In my opinion, a man having time to spare between set-ups should use it to better advantage than by sitting and watching the tool cut. He should be given something else to do, either running another machine, tapping, filing, or assembly work. This is more satisfactory to the man as well, as the time will not drag as much when he is busy.

On the other hand, a man working on a small drilling machine or similar tool, on a continuous operation, might well sit down while working. The question of sitting depends greatly upon the character of the job and whether greater production or quality can be obtained by sitting or standing. To keep a workman rested is always an insurance of more and better work.

JOSEPH E. ABBAZIA

THE TRAINING OF APPRENTICES

In many large shops where apprentices are trained for the machinist's and toolmaker's trade, practice in chipping and filing has been entirely eliminated. Many trade schools have also eliminated chipping and filing from their courses. This is a mistake, in my opinion, because chipping and filing develops muscular control and manual skill that may be valuable in many instances. In some shops a man who cannot use a file effectively is considered a poor mechanic. On the other hand, some of the time spent in apprentice courses in teaching mathematics and drawing could be saved, because the boy can obtain training in these subjects in night schools and from books.

C. KUGLER

A TRADE ASSOCIATION NEEDED

There are trade associations in almost every field of the industry except in the metal-cutting tool field. An urgent need exists for an association in this field as well. There are many things that need standardization, there are many policies that ought to be made more uniform, and many trade customs that need change or modification. Why cannot the metal-cutting tool manufacturers have an association as active as the National Machine Tool Builders' Association is? Doubtless many problems could be handled in conjunction with the latter association, as all the products made by the metal-cutting tool manufacturers are used in connection with the machines built by machine tool builders.

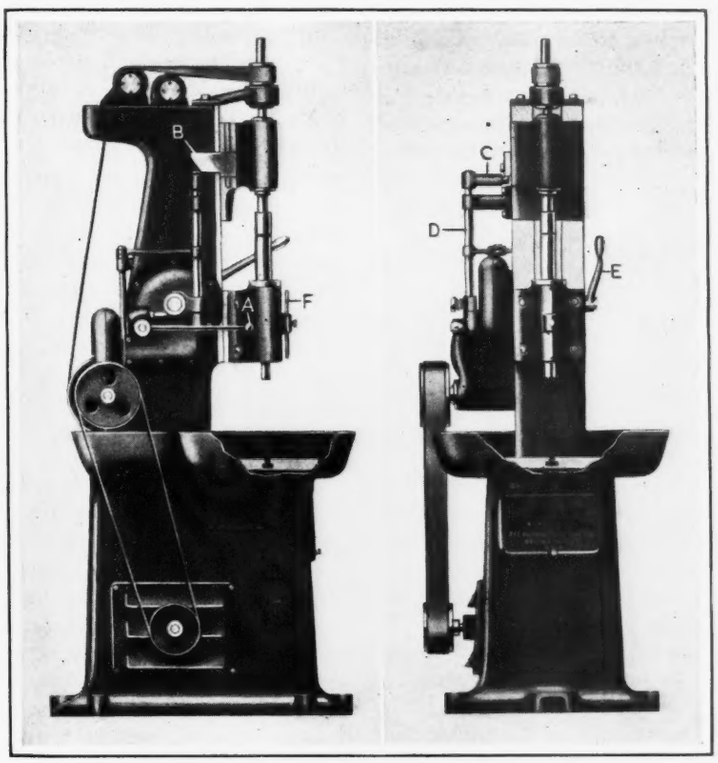
OBSERVER

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

COULTER GENERAL-PURPOSE DIAMOND-TOOL BORING MACHINE

Diamond boring a large variety of parts may be performed on a Coulter single-spindle machine which is now being brought out for general-purpose service by the Automatic Machine Co., Bridgeport, Conn. This machine has a capacity for boring holes of various diameters up to 6 inches long in many kinds of work, such as, motor parts, air cylinders and valves, bushings, etc. It is designed for machining bronze, brass, aluminum, babbitt and other soft metals to within extremely close dimensional limits and to a high degree of finish. The machine is not intended for high-speed production as the two-spindle machine built by the same concern, is particularly designed for such work. The two-spindle machine was described in August, 1926, MACHINERY, page 1001.



Coulter General-purpose Diamond-tool Boring Machine

One of the advantages of diamond boring is the large number of parts that can be produced before resharpening, or even before readjustment of the diamond tool is necessary. In one operation on bronze bushings, 3/4 inch inside diameter and 2 1/2 inches long, from 15,000 to 16,000 holes were bored before the tool required dressing. To guard against any vibration, which would tend to crumble the diamond in use, the hardened and ground boring-bar of the new machine runs in a lapped bearing made from 8 to 12 inches long. This bearing is lapped to suit the speed at which the boring-bar of each machine is to be run. Lubricant is constantly fed under pressure to this bearing, a very thin lubricant being used, as an ordinary lubricant would cause the boring-bar to stick. Fixtures of various designs may be mounted on the table for holding different kinds of work.

Power for driving the machine is derived from a 3-horsepower motor in the base, which runs at 1800 revolutions per minute, and delivers the power through pulleys and a belt to a shaft at the rear of the machine. At the right-hand end of this shaft, there is a combination cone clutch and pulley from which power is transmitted by belt over idlers at the top of the machine to the spindle which drives the boring-bar. The spindle is connected to the boring-bar through an Oldham coupling.

From the pulley shaft at the back of the machine, power is also delivered through two sets of worm reduction gearing to a shaft extending through the machine at the middle of the column. On this shaft, there is a wide-faced pulley over which a steel belt runs to an idler pulley located near the top of the machine within the column. The spindle head is fastened to this steel belt in such a manner that the head is moved downward with the belt in an operation, so as to feed the boring tool through the work. The drive from the worm gear of the second reduction, to the shaft on which the steel-belt pulley is mounted, is through a tooth-clutch.

In an operation, the rotation of the spindle and boring-bar and the feeding of the spindle head are started by moving lever *A* slightly, to permit automatic engagement in quick succession of the combination cone clutch and pulley in the drive to the spindle, and of the tooth clutch in the drive to the steel belt. Then the spindle head feeds downward at a uniform rate until the work is finished, at which time trip *B* strikes arm *C*, and through it causes shaft *D* to swivel. As this shaft turns it causes the disengagement of the two clutches, so that the feed of the spindle head and the rotation of the spindle stops. The two clutches are locked in disengagement until handle *A* is again raised, at which time the clutches are forced into engagement.

After the machine is stopped at the end of an operation, handle *E* is lifted to revolve the steel-belt pulley backward by hand, thus raising the spindle head and the boring-bar. A counter-balance facilitates raising of the head. Arrangement could conveniently be made for automatically raising the spindle head and boring-bar at the time that the clutches are disengaged. With the boring-bar

stationary during this withdrawal from the work, no damage results to the work. The length of the spindle head movement and the extreme points of the movement may be regulated to suit any job.

Diamond-equipped extensions are fitted into the tapered and threaded spindle nose socket to permit boring to different diameters. Dial indicators may be mounted on rod *F* at the front of the boring-bar housing to provide for setting the diamond tools accurately. In addition to boring, some turning operations can be performed by employing a hollow tool-holder with a diamond inserted on the inside, for feeding over the ends of work.

Spindle speeds and feeds can be arranged to meet the requirements, but in boring to ten-thousandths of an inch, which is the class of work for which the machine is primarily intended, a feed of about 0.001 inch per spindle revolution is considered preferable. Boring speeds of 4 inches and more per minute are obtainable. The depth of cut usually recommended is 0.004 or 0.005 inch. On the table, there is a finished surface, 14 by 22 inches, to receive work-holding fixtures. The distance from this finished surface to the under side of the boring-bar bearing is 12 inches. The machine occupies a floor space of approximately 30 by 36 inches and weighs about 2500 pounds.

ILLINOIS UNIVERSAL HOB AND WORM TESTING MACHINE

All important elements of hobs and worms may be accurately tested in a machine recently developed by the Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill. This machine is intended for work up to 15 inches in diameter and 30 inches in length, but it will swing work 20 inches in diameter, and has a capacity of 40 inches between centers for work of special shapes, the weight of which is not in proportion to the bulk. The machine is arranged for testing the lead, pressure angle, and contour of the teeth, of both straight and helically fluted hobs, and of corresponding parts of worm threads. It will also test the concentricity of the relief clearance of hob teeth, and the spacing of threads or starts on multiple-threaded hobs and worms.

Fig. 1 shows a front view of the complete machine which consists essentially of a bed, headstock

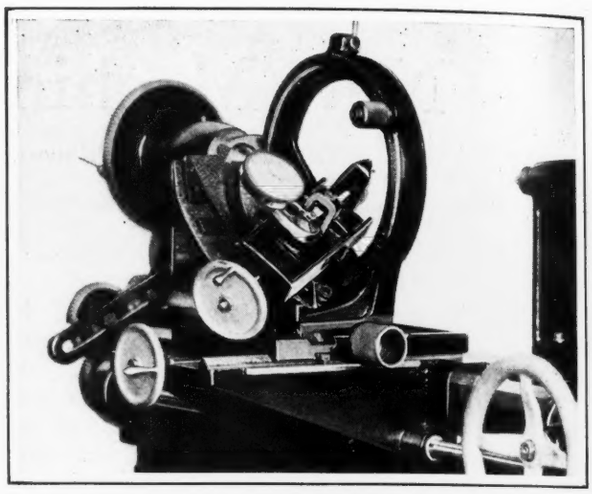


Fig. 2. Setting Employed in Testing the Profile of a Left-hand Hob or Worm Thread

with spindle, tailstock, carriage, lead-screw and change-gears. The change-gears interconnect the spindle and the lead-screw. On the carriage is a universal testing head, which is shown set in the horizontal position in Fig. 1, as employed for testing the pressure angle or the tooth contour of a straight gashed hob, or the axial inclination of the sides of worm threads.

In making a lead test, the proper gears for the required lead are placed on their respective shafts and studs at the headstock end of the machine, and adjusted to mesh freely. Change-gears are provided to cover the lead of common pitches of gear hobs, and other gears can be furnished for any lead. The work is placed between the centers to be driven by the headstock spindle. The contactor of the testing head is brought forward to engage the work at the desired depth (usually at the pitch line), and the indicator is adjusted to zero.

A handwheel mounted on a bracket that may be moved to a convenient position along the bed is turned for operating the machine. This handwheel is geared to a transmission shaft through worm-gearing, and the shaft is connected to the lead-screw through spur gears. A clutch may be disengaged to release the worm-gear, so as to allow it to turn freely on the transmission shaft when it is desired to quickly return the carriage to a start-

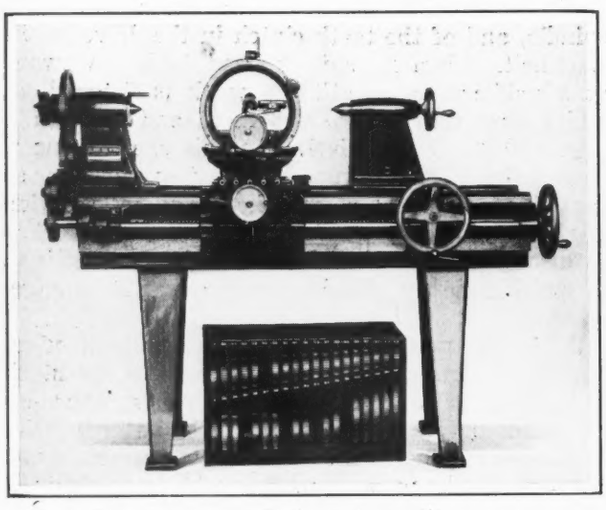


Fig. 1. Illinois Universal Testing Machine for Hobs and Worms

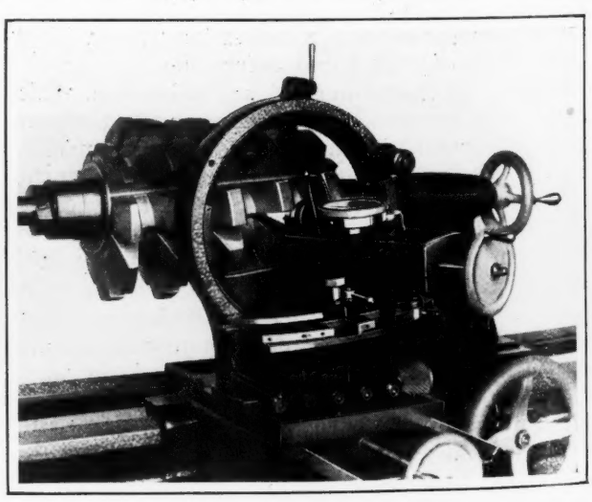


Fig. 3. Testing Head Positioned for Tests on a Single-thread Spur-gear Hob

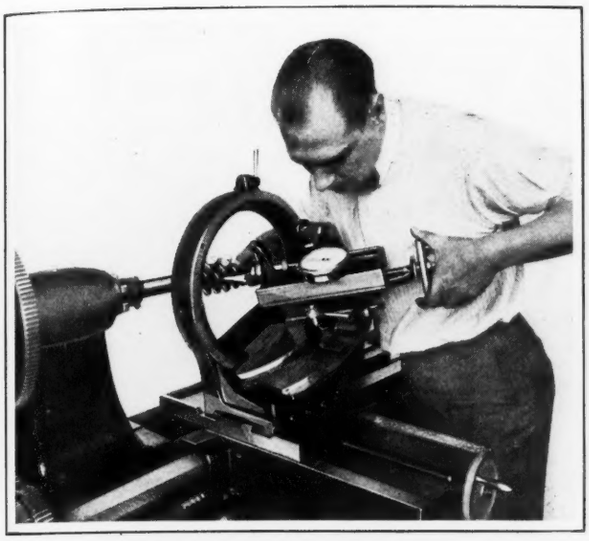


Fig. 4. Method Employed in Testing a Multiple-thread Worm or Worm-gear Hob

ing position. The handwheel mounted on the end of the lead-screw is revolved to return the carriage at the quick rate.

Fig. 2 shows the testing head with the indicator positioned for testing the profile of a left-hand hob or worm thread having a 45-degree helix angle and a 30-degree pressure angle. The testing head is adjusted to the helix angle by means of the knurled knob on the right-hand upper quarter of the vertical swivel-ring housing. The proper setting is facilitated by a vernier scale on the left-hand side of the swivel ring. The swivel ring is held in position by a clamp screw on the top, at which point the housing is split.

One end of the table, which supports the testing unit, is rigidly fastened to the swivel ring, while the other end is supported by a segment which is concentric with the ring. The testing unit consists of a base, which is angularly adjustable on the table, a slide on this base, and a reversible test indicator. The base may be set at any angle on the table, up to 30 degrees, by using a sine bar and a button. Positive stops in the form of plugs and bushings are provided for setting to the common angles of 14 1/2, 20, and 30 degrees. Bolts are provided to rigidly fasten the base to the table in any predetermined angular position.

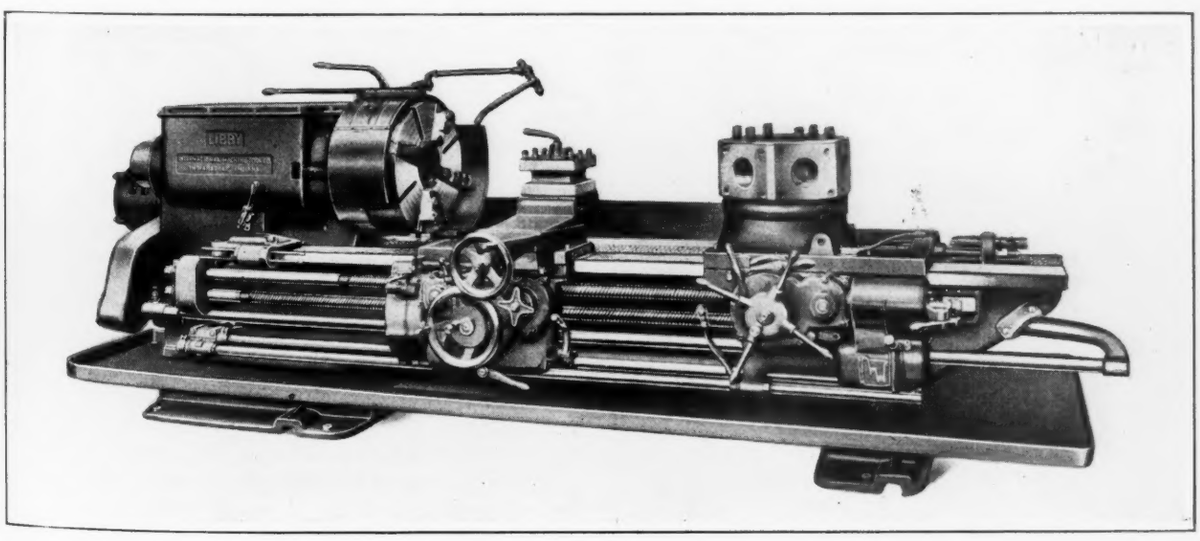
Fig. 3 shows the testing unit positioned for testing either the lead, pressure angle, or profile of the teeth on a large single-thread spur-gear hob. Fig. 4 illustrates the method of testing the pressure angles and profiles of the threads or teeth of a multiple-threaded worm or worm-gear hob. This universal hob and worm testing machine weighs approximately 2300 pounds.

LIBBY HEAVY-DUTY TURRET LATHE

A type C-H machine has recently been added to the line of Libby heavy-duty turret lathes manufactured by the International Machine Tool Co., Indianapolis, Ind. This new machine has a swing over the ways of 27 inches, and may be furnished with either an 8 1/4- or 10 1/4-inch hole through the spindle. It embodies such well-known Libby features as flat ways, a full swing over the side carriage, a side carriage which passes the chuck, a gibbed bearing on top of the side carriage, feeds for each carriage which are independent of each other, a quick traverse for each carriage independent of the feeds, a spindle made from a solid steel forging, a taper seat on the spindle for the chuck, and automatic oiling of all ways and the cross-slide.

Another feature of the machine is the motor drive, the motor being coupled direct to the main drive shaft, eliminating any possible vibration or chatter from belts or pulleys and obviating any loss of power from belt friction. Improved appearance is another advantage mentioned for this drive. The machine can be furnished with a stationary or a cross-sliding turret, a taper attachment, bar feed, compound rest with a power angular feed, etc.

The ways are flat and provide extensive bearing surfaces for both carriages. They are a part of the bed proper and are so located with relation to the spindle that the front way will receive cutting strains direct, and thus carry the loads due to heavy cutting with minimum and uniform wear. These flat ways are protected from injury and wear resulting from chips, by means of brass scrapers and felt wipers which are attached to both the turret and toolpost slides.



Libby Type C-H Heavy-duty Turret Lathe

Eight spindle speeds ranging from 7 to 162 revolutions per minute are obtainable. Feeds ranging from 1/256 to 1/2 inch per spindle revolution are available, all of them being reversible. Standard threads from 2 to 32 per inch, including 11 1/2 per inch, can be cut with the full set of change-gears, and special change-gears can be furnished for cutting leads up to 2 inches. The machine requires a motor of from 20- to 25-horsepower, running at 1800 revolutions per minute. Some of the important specifications of this turret lathe are as follows: Swing over ways, 27 inches; swing over carriage, 25 inches; traverse of turret carriage, 72 inches; traverse of tool post carriage, 72 inches; maximum boring depth, 23 inches; and approximate weight 16,000 pounds.

GAERTNER CIRCULAR DIVIDING MACHINE

Lines can be accurately ruled around circles up to 25 inches in diameter by means of a precision circular dividing machine recently developed by the Gaertner Scientific Corporation, 1201 Wrightwood Ave., Chicago, Ill. The number of divisions which can be made, depends upon the number of teeth on ratchet wheel *A*, Fig. 2. With a 180-tooth wheel, almost 65,000 spacings can be obtained. At the maximum speed, this machine rules lines at the rate of 48 per minute. Lines of various lengths and in different combinations can be produced on flat, bevelled, or vertical surfaces. The machine is designed for either laboratory or shop use and for automatic operation. Accuracy within plus or minus 1 second of arc is guaranteed.

The table of the machine consists of the machined side of a worm-wheel 24 inches in diameter and having 360 teeth. This combination table and worm-wheel is mounted on a tapered seat of a spindle in the center of the machine. The weight of the worm-wheel, spindle, and work is relieved by a spring at the lower end of the spindle, and the thrust is taken up by a hardened steel ball. To insure uniform accuracy of the machine, it is important that the spring be adjusted according to the weight on the worm-wheel. Such adjustments are conveniently made by turning a screw. Oiling of the spindle is easily accomplished.

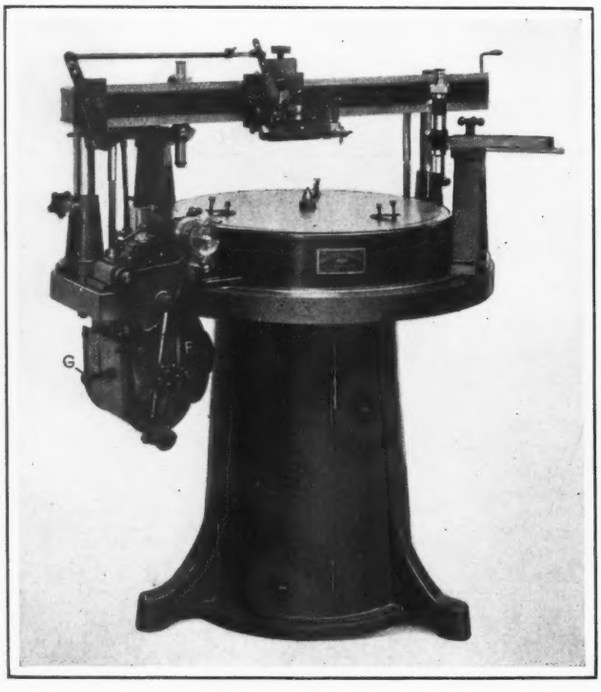


Fig. 1. Gaertner Precision Circular Dividing Machine

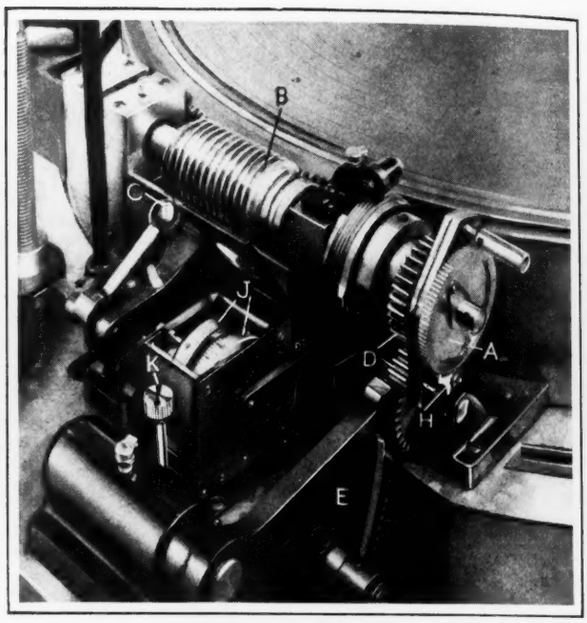


Fig. 2. View of the Drive to the Combined Worm-wheel and Table and of the Stop Mechanism

Eighteen concentric grooves are cut in the table face of the worm-wheel to assist in centering objects, while 54 holes are tapped in this face to facilitate clamping the objects in place. Near the periphery of the worm-wheel, there is an inlaid silver strip that is graduated in 1/6 degrees, every second degree being numbered. The strip is sufficiently wide to receive any other graduations which may be irregularly spaced and copied by making settings with the microscopes.

Thrust of the worm *B*, Fig. 2, which drives the combined table and worm-wheel, is taken by a precision hardened steel ball. The thread of the worm is accurately corrected for periodical and progressive errors by means of a special apparatus which was described in the article "Making Precision Screws for Scientific Instruments" published in June, 1917, MACHINERY, page 849. This apparatus insures that errors in the work resulting from periodical errors in the worm will be less than 1/5 second of arc.

Small inaccuracies in the worm-wheel are compensated for by automatically shifting the worm back and forth along its axis, which is accomplished through a thrust screw. This thrust screw is rotated by means of a lever system in accordance with the errors of the worm-wheel. The lever system is actuated by a cam mounted on the periphery of the worm-wheel below the teeth, this cam being made up of sections. After the errors of the worm wheel have been carefullly determined by employing the usual four-microscope method, the cam is cut while on the machine. As errors in the worm-wheel are small, the rises and falls of the cam are minute.

Worm *B* and the worm-wheel teeth are protected by removable covers. A small door in the worm-wheel cover provides access to the teeth for occasional cleaning. The worm can be easily disengaged

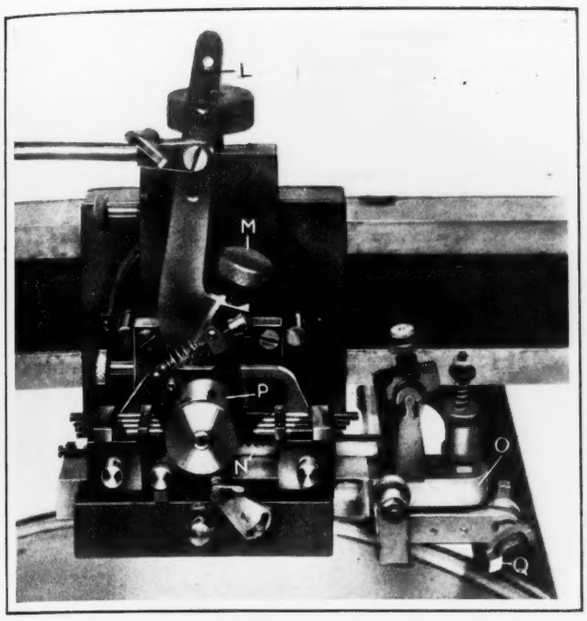


Fig. 3. Tracing Mechanism which Actuates the Tool Across the Work at Desired Stroke Lengths

from the worm-wheel by moving handle *C*. Rotation of the worm is accomplished by means of ratchet *A* and spur gears *D* which are driven by gear sector *E*. Oscillating motion is imparted to this gear sector by an adjustable crank-lever that is mounted on a shaft, together with an eccentric which operates the tracing mechanism seen in Fig. 3. This shaft is rotated by worm-gearing which is driven by the three-step cone pulley *F*, Fig. 1. This pulley is driven by a 1/4-inch round belt that is connected to a 1/8-horsepower motor running at a speed of 1200 revolutions per minute. The main-drive worm-gearing and the ecccentric for operating the tracing mechanism are protected by a steel casing that is provided with oil reservoirs for lubricating the parts. In starting the machine, handle *G* is lifted to engage worm and wheel.

Five ratchet wheels *A* with different numbers of teeth are furnished with the machine and these permit graduating to all the usual spacings. The motion of pawl *H*, which advances the ratchet wheel, is imparted by a gear mounted concentrically with the worm-shaft, but turning on an independent bearing. Engagement and disengagement of the pawl with the teeth of the ratchet are accomplished by a friction device which gives a positive noiseless action without wear of the ratchet teeth. An automatic stop mechanism provides for stopping the machine precisely when any desired number of lines from 1 to 10,000 has been ruled. As seen at *J*, this device consists of two disks, each of which is divided into 100 parts and numbered. The machine can be stopped at any time independent of the stop mechanism by pulling knob *K*.

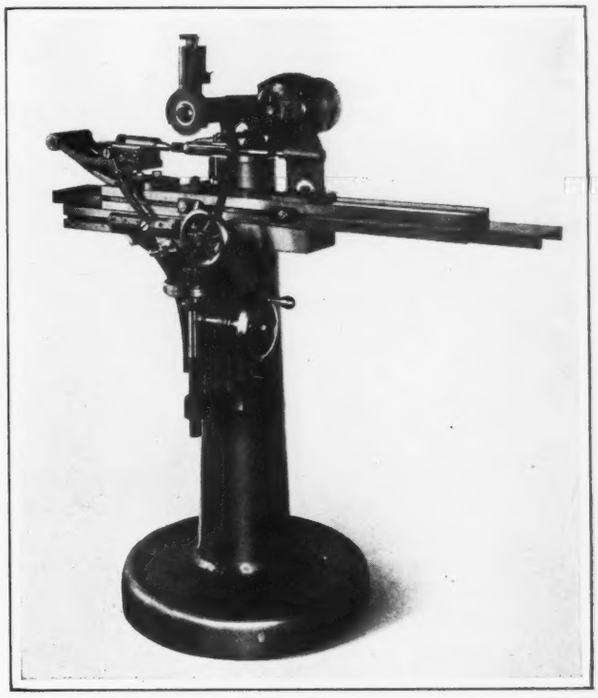
The tracing mechanism illustrated in Fig. 3 is operated by lever *L* which is connected through a rod to the bellcrank lever seen at the left-hand end of the machine in Fig. 1. The tracing mechanism permits the ruling of lines up to about 1 inch long. Lever *L* actuates a spur gear through a friction clutch that is adjustable through screw *M*. This adjustment provides for cutting heavier or lighter lines. The spur gear engages rack *N* which is attached to slide *O*, so as to carry back and forth the hinged tool-holder of the engraving tool *Q*.

Rack *N* has a slight amount of play on the slide; this play is utilized at the beginning of the forward stroke to swivel the tool-holder, so as to lower the tool on the work. At the end of the forward stroke, the play is utilized to raise the tool from the work. On the slide are two sets of opposing stop screws which limit the length of the lines being graduated by contacting against drum *P*, so as to control the length of the slide strokes. When different lengths of lines are to be graduated, the drum indexes between strokes, so as to permit the various stops to enter holes in the side of the drum, and thus become inactive when shorter stops are to contact with the drum. Thus, long and short lines in various combinations can be produced by selecting the proper type of drum and adjusting the stop screws accordingly. The movements of lever *L* are always the same length regardless of the length of line being cut.

The entire tracing mechanism is mounted on a vertical slide which may be adjusted about 1 inch. The entire unit can also be set at an angle from horizontal to vertical, so as to permit the graduating of inclined, flat or vertical surfaces. The tracing mechanism is mounted on a cross-beam and can be clamped at any point along the beam. The height of the beam above the combined table and worm-wheel may be varied by turning a crank-handle to actuate two elevating screws. The maximum distance between the dividing tool and the top of the worm-wheel is 5 1/2 inches. Two microscopes which are mounted on adjustable brackets, as shown, are supplied. The weight of the machine is approximately 720 pounds.

CLEVELAND CIRCULAR RELIEF GRINDER

An improved machine designed for grinding circular relief on various styles of reamers, milling



Circular Relief Grinder Brought Out by the Cleveland Tool Engineering Co.

cutters, taps, core drills, and other tools, is being introduced on the market by the Cleveland Tool Engineering Co., Main and West 25th St., Cleveland, Ohio. For grinding relief on tools with this machine, the outside face of the grinding wheel is dressed concavely to the same curve as the tool to be ground. The tool is offset from the center of the wheel curve to give the desired clearance. In one operation, the relief is ground clear to the cutting edge. The degree of clearance is determined by the distance that the tool is moved in or out against the curve of the grinding wheel.

One of the principal improvements of the machine is a cam device intended for use in grinding forms longitudinally on taps and reamers. From the illustration it will be seen that the headstock mechanism is mounted on trunnions, so that a swinging movement can be imparted to it. This swinging movement is controlled by a lever which carries a roll that bears against a cam plate. The cam plate has a contour similar to that which is to be generated on the tool during the grinding process.

The elevating screw is graduated to 0.0001 inch, whereas the cross-slide screw is graduated to 0.001 inch. The head is graduated in degrees and may be swiveled for grinding to spiral angles. Other features include frictionless scale point centers, a quick-acting spring-tension center, an adjustable positive stop for back tapers, and a graduated adjustable diamond wheel dresser. The maximum table travel is 26 inches, and the maximum swing on center is 7 inches. The machine weighs about 600 pounds.

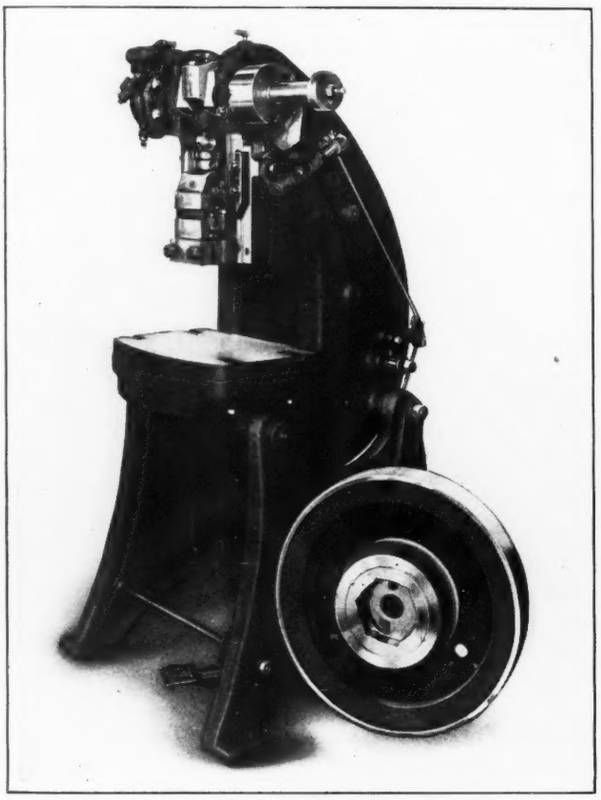


Fig. 1. "Canco" Open-back Inclinable Power Press

"CANCO" IMPROVED POWER PRESSES

Power presses of various types and capacities are being placed on the market by the American Can Co., 120 Broadway, New York City. They comprise an improved line which includes presses of the following types: Open-back inclinable; horn and apron; arch; screw; and toggle-embossing. Representative presses of all of these types are shown in the accompanying illustrations.

The open-back inclinable, horn and apron, and arch presses, which are shown in Figs. 1, 2, and 3, respectively, have many features in common. They are equipped, with an improved clutch having six engaging points, as may be seen in Fig. 1, which insures quick engagement of the clutch. The flywheel will not revolve more than 1/6 of a revolution before clutch engagement occurs, after the mechanism has been operated to effect this engagement. Two types of brakes can be furnished, either a cam-actuated brake which is intended for presses operated intermittently, or a treadle-release brake which is designed for continuously operating presses.

The crankshaft of each press is made of chrome-nickel steel and ground all over, while the bearings are scraped in. The slide is of extra length, and is furnished with gibs to suit. The punch-holder is of an improved design and hardened to eliminate marring or scoring. There is a positive knock-out. Finished surfaces permit the convenient application of attachments, feeding mechanisms, gages, etc. The flywheel has a solid web to reduce hazards, and the frame is a semi-steel casting. The Dot system of lubrication insures an adequate supply of lubricant to all important bearings. Increased die space is another feature.

Three inclined positions are available on the inclinable presses without an inclining attachment, but such an attachment can be supplied if desired. The inclinable presses are built in seven standard-throat and three deep-throat styles, and with plain or geared drives, the weights ranging from approximately 860 to 9100 pounds. The presses may be driven by belt or motor. The standard slide stroke of all inclinable presses is 3 inches, while the maximum slide stroke ranges from 4 to 6 inches with the different sizes.

A horning press equipped with an apron that may be conveniently removed to facilitate horning operations is illustrated in Fig. 2. It will be seen that the horn hole is large in diameter, to permit the use of horns with sturdy shanks. The apron is a semi-steel casting which is clamped to the press column, and is provided with an elevating device. This table can be equipped with an anti-friction sliding bolster designed with a view to reducing fatigue of the operator, thus enabling increased production. Horn presses are made in four standard-throat and two deep-throat styles, and with either plain or geared drives, the weights ranging from about 980 to 5000 pounds. The standard slide stroke is 1 1/2 inches on all presses, while the maximum slide stroke ranges from 3 1/2 to 6 1/2 inches.

In addition to the increased die space which is a feature of the presses already described, the die space of the arch presses may be further increased by applying a removable front to the bed. This

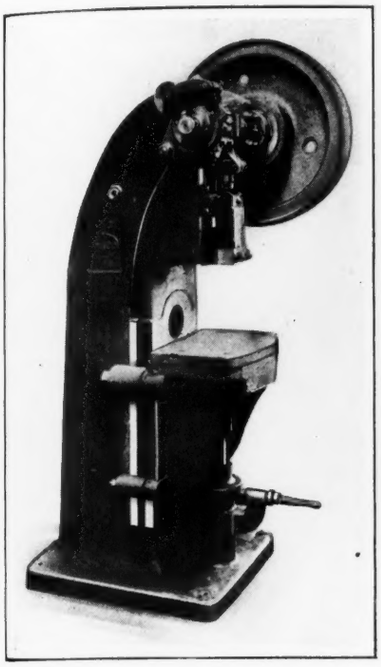


Fig. 2. Horn Press Equipped with Adjustable Apron

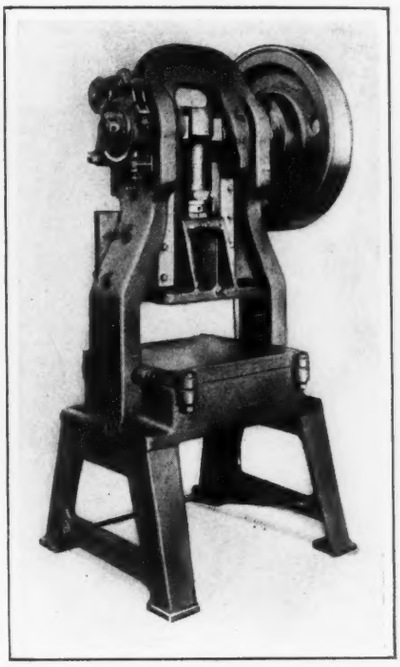


Fig. 3. Arch Press Mounted on Straight Legs

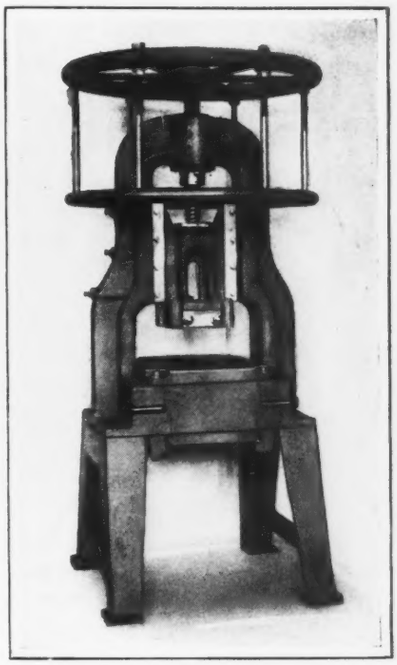


Fig. 4. Screw Press Adapted to Testing Dies

arch presses are particularly suitable for large blanking and forming operations. They may be furnished with inclined legs to permit work to slide from the dies by gravity. Arch presses are made in two sizes, the plain-drive machines weighing 4600 and 6760 pounds, respectively, when arranged for a motor drive (but without the motor); whereas similar geared presses weigh 5200 and 7400 pounds, respectively. The standard slide stroke is 3 inches and the maximum slide stroke 5 and 6 inches, respectively.

Screw presses of the construction illustrated in Fig. 4 are built for testing dies, etc. These machines front adapts the machine to well-type dies, etc. The are fitted with an auxiliary handwheel, which, in addition to providing extra weight, eliminates hazards in operating the machine. Screw presses are made in three sizes which range from 2300 to 4000 pounds in weight.

Fig. 5 illustrates a heavy toggle embossing press, the frame of which is a steel casting. This machine is provided with a slide which is designed with the toggle lever at the bottom and, as a result, the gearing is located close to the floor. Advantages claimed for this construction include less vibration and the elimination of the necessity of a foundation. The weight of the slide and the springs on the front of the press, take up lost motion, so that jars do not occur when the die strikes the work. The toggle lever is a steel casting, while the toggle seats and pins are made of tool steel, hardened and ground.

Adjustment of the upper platen is readily accomplished through a steel wedge which is regulated by means of the handwheel on the left-hand side of the press. There is a dial adjustment for the wedge to enable the operator to keep an accurate record of the settings of dies, so as to insure uniformity in work and save time in setting dies. For safety purposes, a shearing-off pin can be furnished, which is easily accessible for quick replacement in case of overloading. These machines can also be furnished with either a belt or motor drive. They are built in a 150 ton plain style and in geared styles ranging from 150 to 1200 tons in capacity, the weights varying from 4200 to 34,000 pounds.

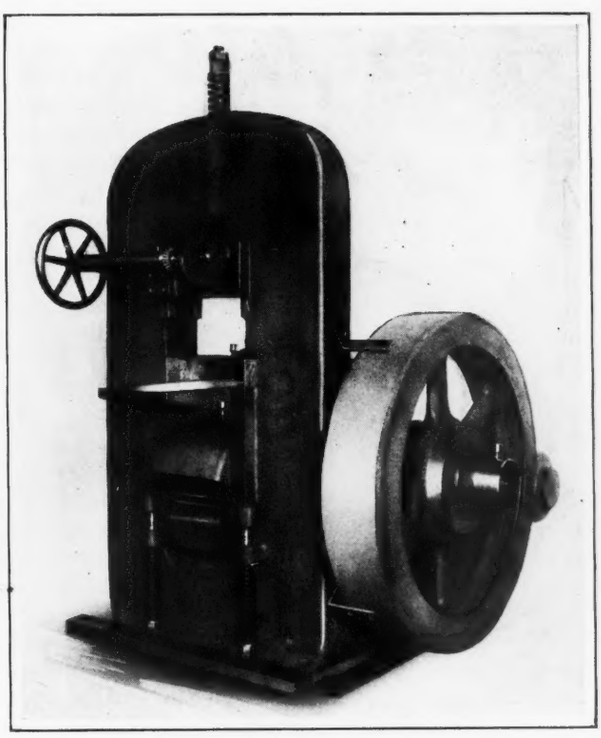


Fig. 5. Toggle Press Built in Capacities up to 1200 Tons

"GUNITE"— A GRAPHITIC STEEL

"Gunite" is a new metal being placed on the market by the Gunite Corporation, Rockford, Ill. It comprises a high-carbon steel in which graphitic carbon is uniformly distributed throughout the castings by a precipitation process. Unusual qualities of strength, toughness, rigidity, and wearability under friction, are claimed for this

new steel. It is stated that microphotographs show "Gunite" to have an even distribution of short graphite flakes throughout the ferrous matrix, which act as lubricating pockets and prevent tearing or scoring of the steel under friction. This new metal is recommended by the manufacturer for brake-drums, clutch plates, cams, dies, gears, surface plates, jigs, heavy-duty bearings, punch frames, steam-engine cylinders, etc.

PUTNAM UNIT HEAD FOR MILLING MACHINES

A self-contained milling head intended primarily for application to planer-type milling machines, has recently been developed by the Shaw Crane-Putnam Machine Co., Inc., a subsidiary of Manning, Maxwell & Moore, Inc., 100 E. Forty-second St., New York City. This head is driven by two motors mounted directly on top. One of these motors provide power for driving the milling spindle, while the other furnishes power for feeding and rapidly traversing the head in both directions along the cross-rail of a machine, as well as for feeding and rapidly traversing the spindle quill up or down. All the mechanism required for furnishing a variety of speeds and feeds is incorporated in the head. The head can be used in either a vertical or horizontal position, and is applicable to standard planer-type and rotary milling machines having one or more milling spindle saddles, as well as to many special-design and single-purpose milling machines.

Fig. 1 shows a special machine built by the same concern which is equipped with one unit head. The table measures 42 to 72 inches, and is driven by means of Oilgear equipment. Fig. 2 illustrates the manner in which four heads may be applied to a large machine.

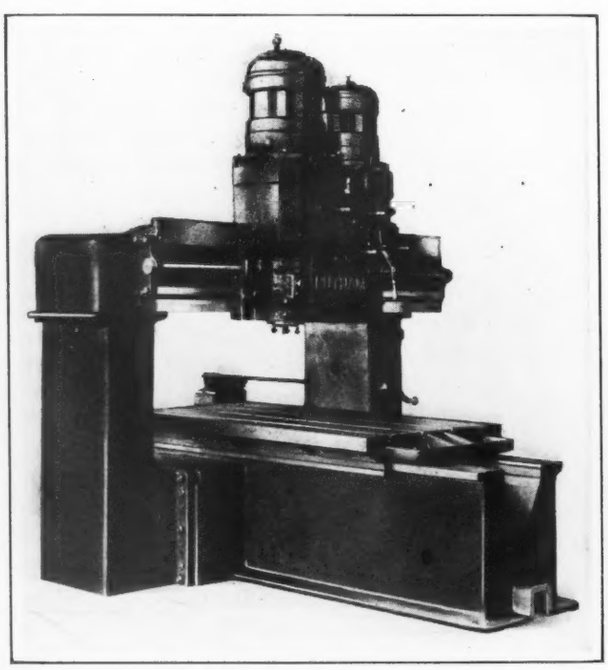


Fig. 1. Putnam Planer-type Milling Machine with Self-contained Milling Head

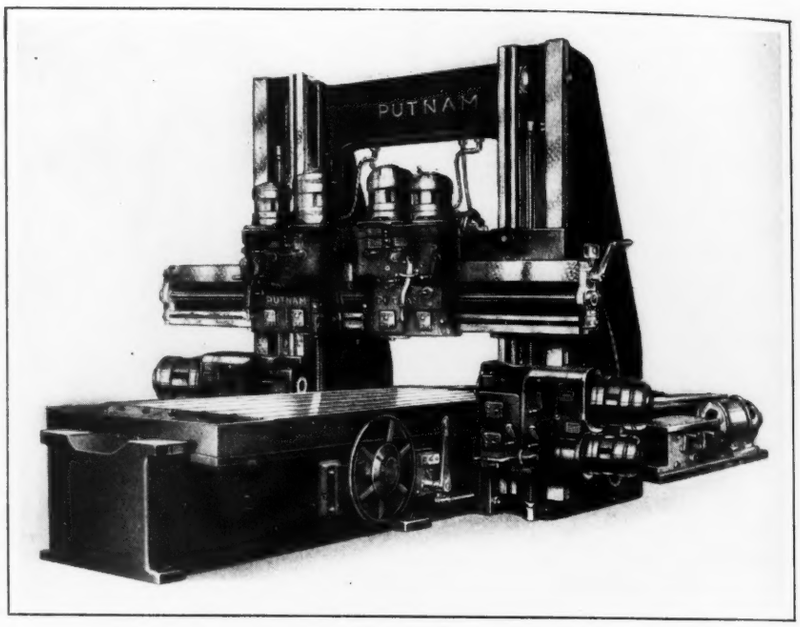


Fig. 2. Four Unit Milling Heads Applied to a Large Machine

A large range of spindle speeds and head or quill feeds can be provided, or the head may have a limited range of speeds and feeds to suit given requirements. Unusual efficiency in power conservation is claimed, due to the comparatively few and short shafts between the one motor and the spindle, and between the other motor and the feed-screw or the spindle quill. When several unit heads are used on a machine, the right spindle speed and milling feed for each head, as well as the desired direction of rotation and feed, can be readily obtained independent of the other unit heads and of the machine table.

Sixteen spindle speeds, ranging from 15 to 306 revolutions per minute, are regularly available in both directions, as well as twelve head feeds from 1 to 12 inches per minute, in both directions. There are also twelve quill feeds, ranging from 0.4 to 48 inches per minute, in both directions. The spindle has a No. 13 Brown & Sharpe tapered socket and a draw rod for use with cutter shanks. It is also provided with a 1-inch key across the nose, and four tapped holes to permit the clamping of cutters to it. The spindle quill has 8 inches of in-and-out travel.

The spindle driving gears are all of helical type, and are mounted on shafts which run in Timken tapered roller bearings. The spindle quill is also mounted in bearings of the same type. The spindle motor has four speeds, and four mechanical changes are obtained through the gearing, thus giving the range of sixteen spindle speeds. The feed and fast-traverse gearing is composed of spur-and-bevel gears mounted on shafts which also run in Timken tapered roller bearings. The feed motor has four speeds, and three mechanical changes are obtained through the gearing to give the range of twelve feeds. Oil is delivered continuously to all gears and bearings through a geared pump. The spindle is

furnished with grease through Alemite fittings in the quill.

The unit head may be clamped in a fixed position on its guide. The spindle quill may also be clamped in a fixed position, and is equipped with a scale and adjustable pointer to provide convenience in making settings. A hand adjustment is furnished for the head and spindle quill in addition to the power feed and traverse.

On the 3 1/2-inch unit head illustrated on the machine, the spindle driving motor is of 5-horsepower capacity, while the feed and fast-traverse motor is of 2-horsepower capacity. Both motors are controlled through push-buttons. Two more unit heads, 4 3/4- and 6-inch, are being developed. These heads will be equipped with 7 1/2- and 3-horsepower motors and 10- and 5-horsepower motors, respectively. All heads are to be made in right- and left-hand styles.

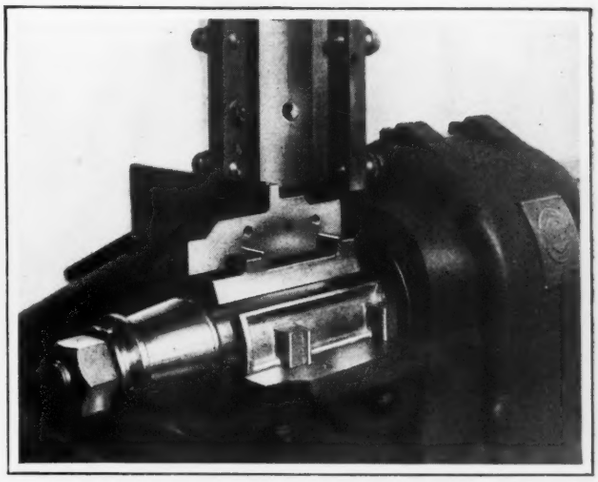


Fig. 2. Construction of Wheel Spindle and One of Its Bearings

NORTON CYLINDRICAL GRINDING MACHINES

Larger type BA cylindrical grinding machines which have a work swing of 14 inches, are being introduced to the trade by the Norton Co., Worcester, Mass. These new machines have been designed primarily for grinding car axles, crankshaft bearings and similar kinds of work. Ample space is provided for work having flanges or other projections up to the full capacity of the machine, and when steadyrests are necessary pieces as large as 6 1/2 inches in diameter may readily be ground. Standard sizes of the machine range from 14 by 36 inches to 14 by 120 inches.

All features of the 10-inch type BA machine are embodied in the new model, including an improved wheel-spindle, ball-bearing wheel feed-screw, chain-driven headstock, selective-gear speed-change mechanism, and anti-friction countershaft bearings in overhead driving arrangements. Either an all-overhead or motor drive can be provided and either a power or hand table traverse.

The new wheel-spindle is designed to withstand severe service and to meet the requirements of precision grinding, being therefore made with large diameters and long bearings as may be seen in Fig. 2. It is readily adaptable to the taking of wide-wheel, straight-in cuts, as well as to traverse grinding. The bearings may be adjusted while the machine is in operation. The lower bearings are fixed, while the upper and outer bearings are adjustable by means of thumb-screws that are easily accessible to the operator. Flood lubrication, which is visible through glasses on the front of the wheel-slide, insures an ample supply of oil for the spindle.

The wheel is driven with a downward pull of the belt which, combined with the weight of the slide itself, eliminates the possibility of lifting under the pressure of a heavy cut. Unusually fine feed adjustments, which incorporate a micrometric arrangement, permit of advancing the wheel to the work in increments of one-eighth of a thousandth of an inch (0.000125 inch). The wheel feed has a large diameter screw which is mounted in ball bearings and engages a long half-nut on the wheel-slide. An even smooth advance of the wheel is insured, which prevents jumping in with consequent irregularities of cuts.

A convenient speed-changing device is arranged with the power table traverse to encourage the use of proper speeds, reduce operating time, and increase production. All speed changes are made at the front of the machine through the selective-gear speed mechanism and can be effected instantly without stopping the table, work or wheel. An independent truing device permits of truing the wheel without disturbing the lever used in making the regular table speed changes.

The work-table is characteristic of the type A machine and any attachments or mechanisms for the 14-inch type A machine may be used on the new model. The headstock may be provided with either a belt or motor drive. Power is transmitted to the drive plate through a silent chain that is provided with an idler for maintaining proper tension. A convenient control is located on the front of the machine. Screw- or lever-type footstocks are ordinarily supplied, but for special work, air- or crank-operated styles are available.

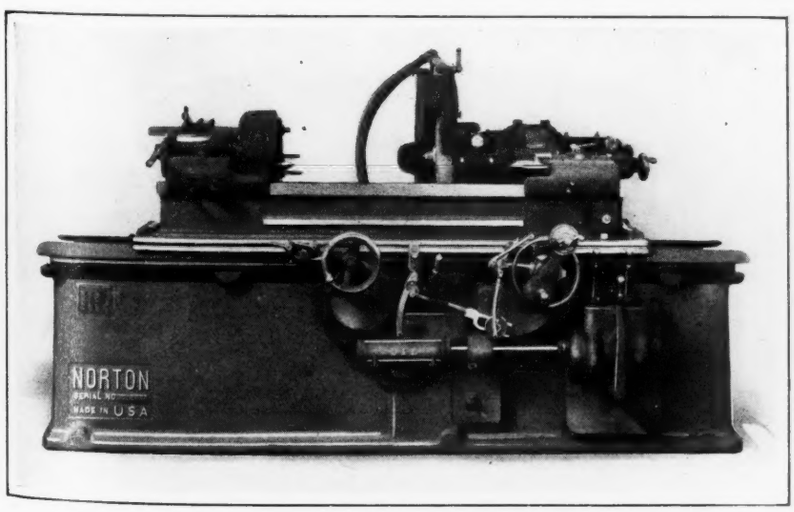


Fig. 1. Norton Type BA Grinding Machine of Increased Swing

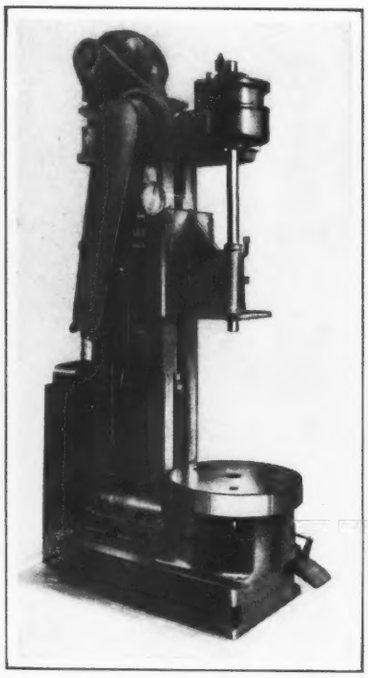


Fig. 1. Baker Boring and Drilling Machine with Hydraulic Feed

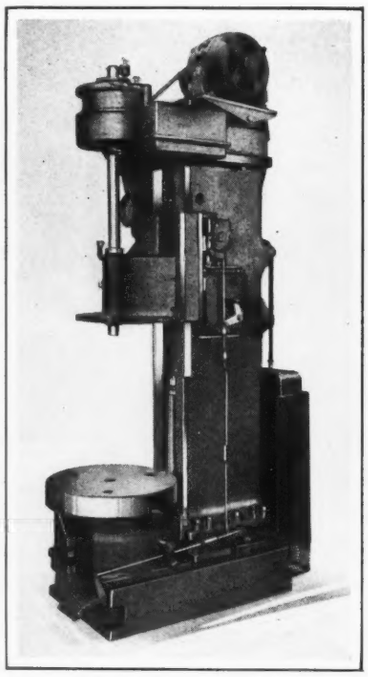


Fig. 2. Right-hand View of Machine Shown in Fig. 1

BAKER HYDRAULIC-FEED BORING AND DRILLING MACHINE

The latest addition to the line of hydraulically equipped machines built by Baker Bros., Inc., Toledo, Ohio, is the No. 10H hydraulic-feed boring and drilling machine here illustrated. The saddle of this machine is designed to permit the attachment of either single-spindle or multiple-spindle heads to meet requirements. The illustration shows the machine fitted with a flanged head for receiving a multiple-spindle head which is not shown in place. Either a plain table can be supplied for single-spindle work or an indexing table, as illustrated, to permit the performance of successive operations. It is possible to provide any number of indexed table positions.

The machine can be furnished as a motor-driven unit only. The motor is mounted on top of the machine and is provided with a "Texrope" drive. An Oilgear pump which drives the feeding mechanism, receives power from the main drive shaft of the machine and, therefore, only one motor is required for both this pump and the main drive.

Speed changes are made by means of slip gears that can be quickly changed when necessary. Various speeds can be arranged for. A wide range of feeds is, of course, available through the Oilgear equipment. The cylinder of this equipment is mounted on the base inside of the frame and imparts a pull stroke to the head.

In an operation, the head advances rapidly to the work, trips automatically to the proper feed for which the machine has been set and moves at this feed until the operation has been completed. The head then automatically returns at a rapid rate and finally stops in its upper position. The points of changing from the rapid advance to the feed and from the feed to the rapid return can readily be altered by means of cams mounted on the side of the saddle.

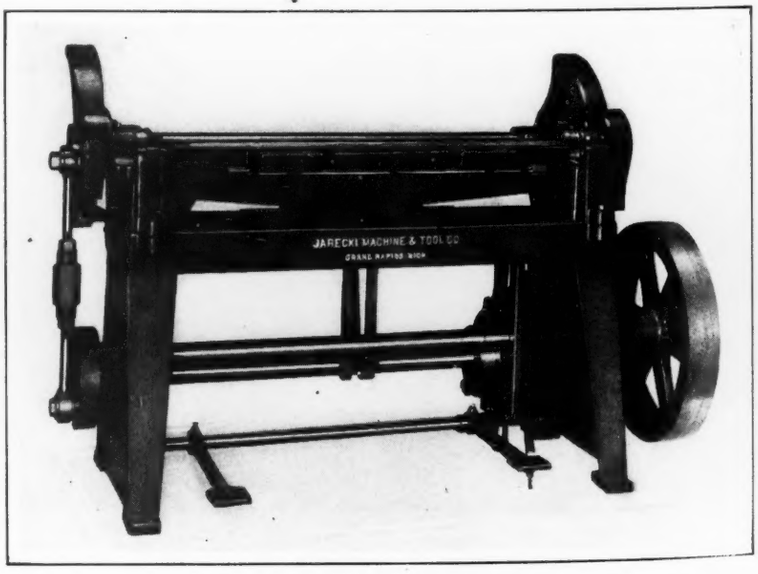
Some of the important specifications of this machine are as follows: Available feed capacity, 5000 pounds; maximum distance from vertical shaft to face of column, 14 inches; maximum distance from lower edge of saddle to base, 50 inches; travel of head, 16 inches; diameter of indexing table, 24 inches; and maximum size of motor, 10 horsepower.

JARECKI POWER FOLDER

A new power-operated folder designed for folding sheet metal up to No. 16 gage has been brought out by the Jarecki Machine & Tool Co., 320 Hall St., S.W., Grand Rapids, Mich. The machine will handle sheets of the gage mentioned, as long as the machine itself. It is regularly built for sheets up to 42 inches long, but greater lengths can be built if required.

A center bearing eliminates springing of the machine, so that sheets are operated on just as efficiently in the center as on the ends close to the bearings. As many hinge bearings as are necessary can be provided along the machine to take care of any springing tendency. The machine is connected at both ends of the shaft. Either a belt or motor drive can be provided.

The flywheel is 24 inches in diameter, weighs 250 pounds and has a speed of 100 revolutions per minute. The ratio of the gearing with which the machine is equipped, is 3 to 1. The machine has an over-all height of 42 inches and occupies a floor space of 30 by 72 inches. It weighs approximately 2400 pounds.



Jarecki Power Folder for Sheet Metal

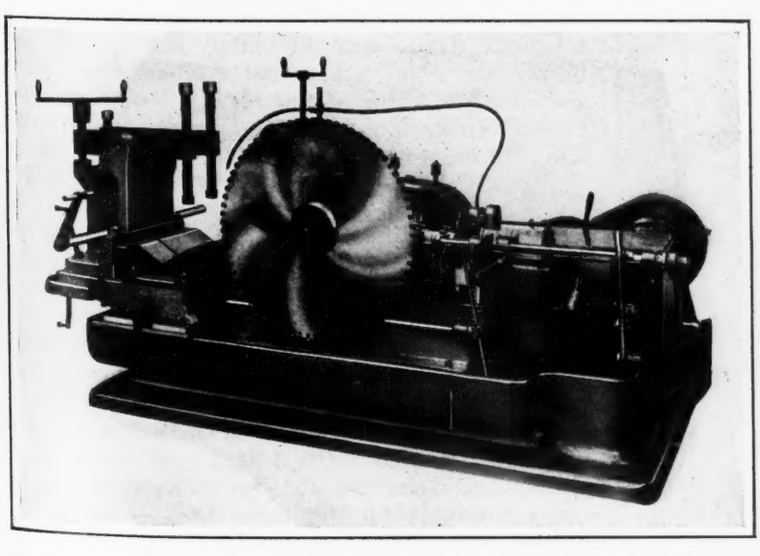
"COBLY" SAWING MACHINE

A metal sawing machine designed for using either a 42- or 48-inch circular saw blade has recently been built by the Cochrane-Bly Co., St. James St., Rochester, N. Y. A 42-inch blade will cut through a 15-inch bar, and a 48-inch blade, an 18-inch bar, without turning the bar. The saw arbor is 6 inches in diameter, hardened and ground, and fitted into a lapped bearing that is located close to the bed.

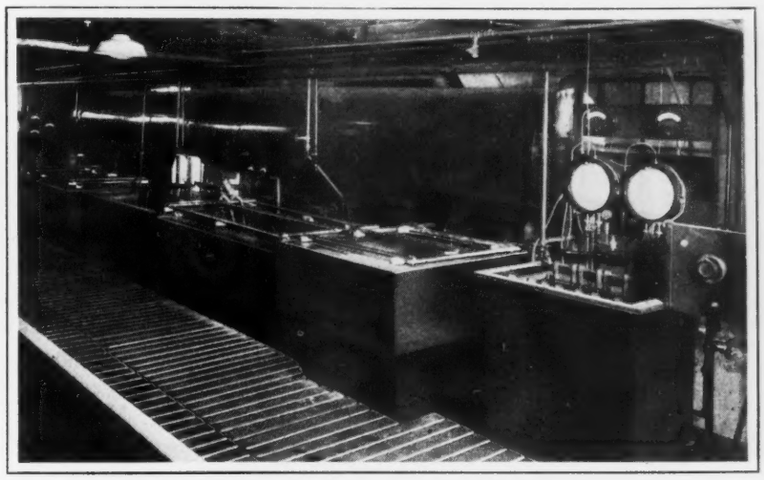
The carriage is fitted with adjustable taper gibs to compensate for wear. To insure alignment and correct fit, the bed is scraped to surface plates. The feed screw is mounted above the ways in line with the center of the saw arbor, and close to the saw blade in line with the cutting and frictional resistance, so as to eliminate vibration due to cant or side pull. Twelve positive geared feeds ranging from 3/4 to 3 3/4 inches per minute are available. A sliding-gear transmission gives three peripheral saw-blade speeds of 45, 60 and 75 feet per minute.

A 25-horsepower constant-speed motor drives the machine through a friction clutch which is controlled by levers located at both the front and rear of the machine. At these points, there are also levers and cranks for starting, stopping, and reversing the feeds, and for adjusting the carriage to and from the work. Adjustable stop-collars provide for automatically stopping and reversing the feeds and give a quick return of the carriage to the point where the saw blade clears the bar being cut. The friction clutch permits the stopping of the saw blade without stopping the motor, and eliminates chances of damaging the blade by moving a loose bar in the vise while the blade is in motion.

In a recent test, the machine cut a 15-inch bar of low-carbon steel in 10 minutes, a 10-inch bar in 4 1/2 minutes, and a 6-inch bar in 1 3/4 minutes, which is at the rate of about 18 square inches per minute. The blade used was 42 inches in diameter and had a 5/16-inch kerf.



Cochrane-Bly Metal-sawing Machine Using Blades 42 or 48 Inches in Diameter



Exhaust System for Chromium Plating Tanks Built by the Cleveland Blow Pipe & Mfg. Co.

EXHAUST SYSTEM FOR CHROMIUM PLATING TANKS

An exhaust system for removing injurious fumes from plating tanks is now built by the Cleveland Blow Pipe & Mfg. Co., 6950 Kinsman Rd., Cleveland, Ohio. A sheet-metal duct surrounds the top of the tank, and on the side facing the liquid a narrow slot is cut. A certain volume of air is drawn through this slot at a predetermined high velocity, depending upon the size of the tank; and the "suction blanket" thus formed over the tank prevents any fumes from entering the room. The operator is therefore protected, and as the top of the tank is not obstructed by overhead exhaust hoods, his work is made easier. Only a small amount of power is required to run the exhaust fan.

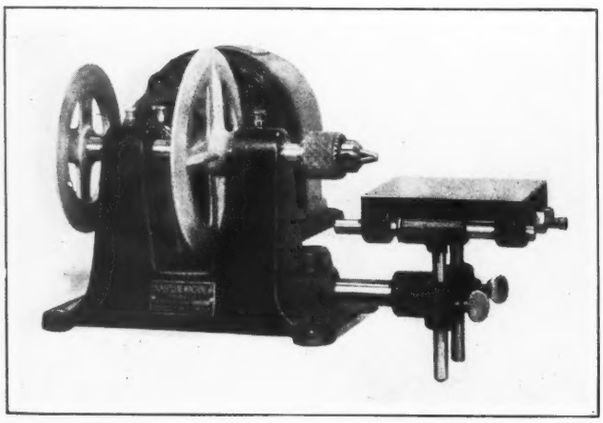
The latest equipment built has been installed in a large automotive plant for removing fumes from chromium plating tanks.

MOTOR-DRIVEN FRICTION TAPPING MACHINE

Unusual sensitiveness and speed of operation are the principal features claimed for a motor-driven tapping machine being introduced to the trade by the Industrial Machine Co., 330 S. Dearborn St., Chicago, Ill. Power is delivered from the motor to the tapping spindle through friction pulleys as illustrated. A leather driving pulley is mounted on the motor shaft, but is supported by another shaft which extends from this pulley into a bronze bearing on the machine.

Fixtures for holding work can be easily attached to the adjustable sliding table to facilitate tapping operations. This table has a maximum travel of 1 1/8 inches. The dimensions of the table top is 4 3/8 by 4 1/2 inches. An adjustable stop-screw on the table provides for conveniently tapping to the bottom of holes. The machine is equipped with a Jacobs 1/4-inch chuck.

A Westinghouse 1/4-horsepower motor running at 1725 revolutions



Friction-driven Tapping Machine Built by the Industrial Machine Co.

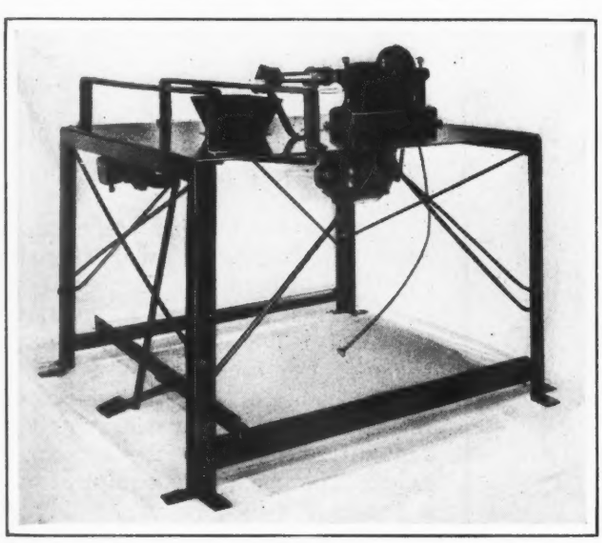
per minute gives a tapping speed of 1000 revolutions per minute, and a tap reverse speed of 1400 revolutions per minute. The distance from the center of the spindle to the base is 5 3/8 inches. The machine has an over-all length of 18 inches, an over-all width of 14 inches, and an over-all height of 9 inches. Including the motor, chuck, and sliding table, the net weight of the equipment is 47 pounds.

PROCUNIER NUT DRIVING MACHINE

A machine recently developed by the Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill., for use in driving on or removing nuts from threaded work, is here illustrated. This machine consists of the bench tapping machine made by the same company, which is mounted on a table, and equipped with a special socket wrench and a Procunier safety friction chuck.

The machine is driven by a motor through a sprocket chain. The friction chuck slips when the nut is driven "home." Protection against damage to the motor, if the friction device were set too tight, is afforded through an electrical overload switch, which automatically breaks the circuit when the machine is overloaded.

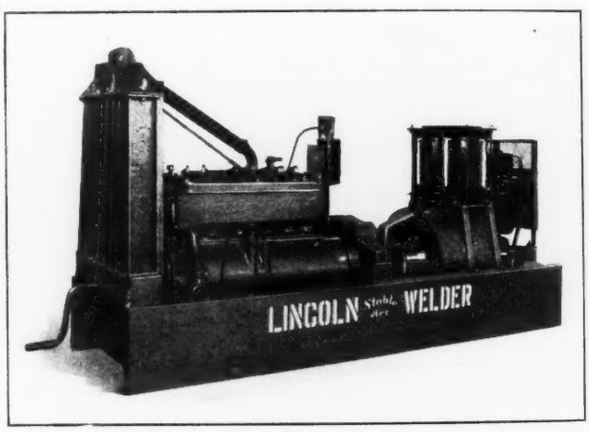
The particular machine illustrated is designed for handling large U-bolts. These parts are laid across the rack bars on the table to bring them into convenient position for the socket wrench. The direction of spindle rotation is reversed in backing off a nut by merely tripping the foot treadle, so as to engage the reverse clutch of the machine. A nut backed off in this manner will drop through the hopper into a container placed on the floor beneath the table. Other arrangements of this machine can be easily worked out to suit a variety of work.



Procunier Equipment for Driving On or Removing Nuts

LINCOLN GASOLINE-ENGINE DRIVEN WELDER

The Lincoln Electric Co., Cleveland, Ohio, has recently built a gasoline-engine driven welder known as Model S-1964. The welding generator of this equipment is rated at 300 amperes, in accordance with the standards of the National Electrical Manufacturers' Association, and has a current range of from 75 to 400 amperes for metallic electrode welding. It is direct-connected to a six-cylinder Buda model HS-6 engine which operates at 1500 revolutions per minute.



Lincoln Electric Welder Driven by a Gasoline Engine

Both units are mounted on a welded steel base, thus giving maximum strength and rigidity with minimum weight. The engine has an S.A.E. rating of 27.3 horsepower and gives 41 brake horsepower while running at the operating speed. The gasoline tank is located in the channel-iron frame under the engine, thus eliminating fire hazard.

The generator has the same features of laminated magnetic circuit with separately excited field, stabilizer, variable-voltage and steel-construction as the company's line of "Stable-Arc" welders. The over-all dimensions of the equipment are, 93 inches long, 35 inches wide, and 45 inches high.

MILBURN IMPROVED PAINT SPRAY GUN

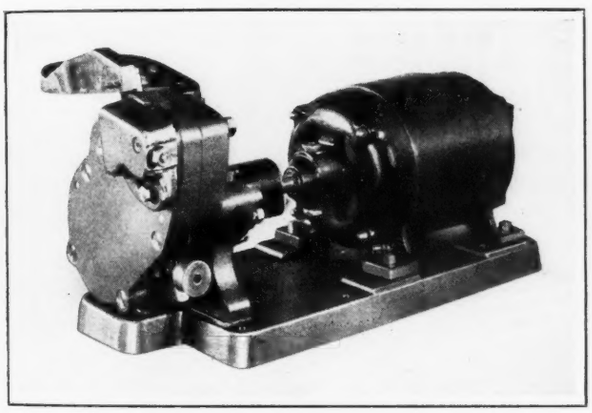
A type EF paint spray gun, which incorporates two important improvements, has been added to the products of the Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md. One of the improvements consists of a dial head which permits numerous spray adjustments from a circular to a wide fan spray. Any desired spray can be instantly obtained without first making tests.

The second feature consists of a series of indicator numerals on the paint valve plunger. A pointer is operated along these numerals as the operator turns the adjustment button. Just as the

dial in the head permits of readily producing the desired spray, so the indicator numerals on the plunger provide a means of obtaining the volume desired without the necessity of losing time by testing. The operator, who has previously found that a certain class of work is best performed when the indicator points to a certain figure, can make the proper adjustment before starting to spray. The new dial air-control valve and the plunger may also be applied to the type E guns already on the market.

"UNISHEAR" METAL-SHEARING MACHINE

The latest addition to the line of "Unishear" metal-shearing machines built by the Unishear Co., Inc., 270 Lafayette St., New York City is the model A-10 here illustrated. This model has capacity for cutting cold-rolled steel up to No. 10 U. S. gage, and softer metals in proportion. Cutting speeds up to 10 feet per minute are obtainable. The machine embodies the principles of other "Unishear"



"Unishear" Metal-shearing Machine

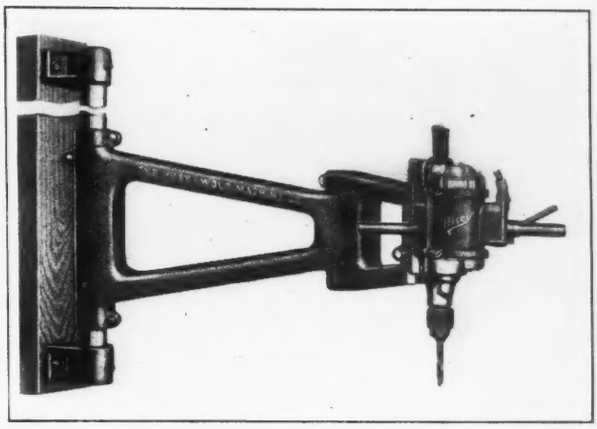
equipment previously described in the editorial pages of MACHINERY. It is driven by a 3/4-horsepower General Electric motor, which may be supplied for various voltages and cycles. It is equipped with a sheet stabilizer. The weight of the new model is about 165 pounds.

HISEY SENSITIVE RADIAL DRILLING ARM

The double radial arm here illustrated can now be furnished for all Hisey portable electric drills up to and including the 7/8-inch size, manufactured by the Hisey-Wolf Machine Co., Cincinnati, Ohio. This arm is equipped with a lever feed which operates through a rack and pinion, permitting a sensitive control without fatigue of the operator.

The motor holding brackets are so designed that a portable drill can be attached without removing any part of the machine. The radial arm is mounted on a ball-thrust bearing which reduces friction to a minimum and permits easy adjustment. By means of individual swivel clamps, either the long or short arm can be locked independently, and if the work requires it, both arms can be locked in any fixed angular position.

Some of the important specifications of this arm are as follows: Vertical adjustment by means of the lever, 7 1/2 inches; vertical adjustment up and



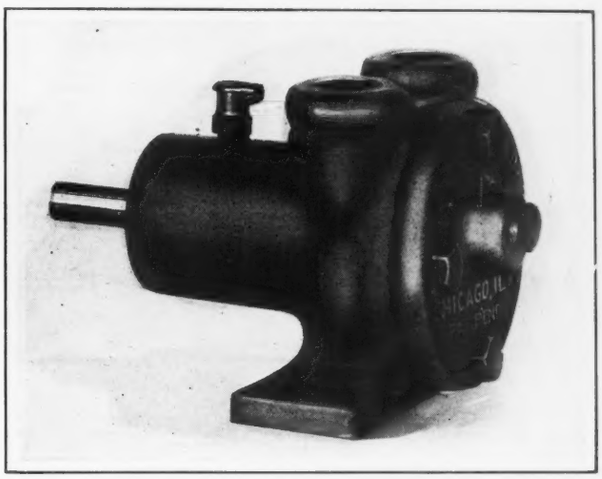
Hisey Radial Arm for Portable Electric Drills

down on the main column, 25 inches; total vertical adjustment, 32 1/2 inches, maximum reach of arm from the column to the drill spindle, 36 3/4 inches; and net weight, 215 pounds.

TUTHILL PUMP FOR PRESSURE LUBRICATION AND HYDRAULIC FEEDS

A small high-pressure packingless pump is now manufactured by the Tuthill Pump Co., 131 W. 63rd St., Chicago, Ill., for use in the pressure lubrication of machinery and in the operation of hydraulic feeds. This model B "Typhoon" pump, like all other pumps made by the same concern, operates on the internal gear principle. However, it embodies a "two-zone" packingless feature, a new patented metallic seal insuring freedom from leakage when pumping lubricating oils at pressures as high as 500 pounds per square inch, and 28 inches of vacuum.

When properly installed with both ports in a vertical position and with a tight suction line, the pump will always maintain its prime. This feature is especially important in machine-tool applications. Two sizes of the model B pump are available, one having a capacity for delivering 30 gallons of oil per hour, and the other, 90 gallons per hour, at a speed of 1800 revolutions per minute. Both sizes may be obtained with either the foot mounting illustrated, or with a flange mounting which is convenient for building the pump into a machine.



Tuthill Pump for Pressure-lubrication and Hydraulic-feed Systems

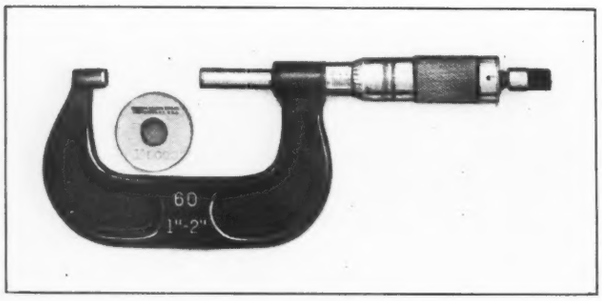


Fig. 1. Brown & Sharpe Micrometer Caliper Brought Out in Two Sizes

BROWN & SHARPE MICROMETERS

Two new micrometer calipers, known as Nos. 60 and 62, are being placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. These micrometer calipers are graduated to read in thousandths of an inch or in hundredths of a millimeter. They are of the construction illustrated in Fig. 1. The No. 60 micrometer caliper measures from 1 to 2 inches, and the No. 62, from 2 to 3 inches. Both micrometer calipers have solid anvils, and a simple adjustment to compensate for wear of the measuring surfaces. In design they are similar to the Nos. 61 and 63 micrometer calipers made by the same concern, except that they do not have clamp-rings. They may be furnished with or without standards, and with or without ratchet stops.

The Brown & Sharpe Mfg. Co. has also brought out a line of No. 276 tubular inside micrometers, one of which is illustrated in Fig. 2. These micrometers are made in three sizes for measuring, respectively, from 12 to 22 inches, from 22 to 32 inches, and from 32 to 42 inches. Each tool is graduated in thousandths of an inch, and the measurement range of each tool is obtainable with ten interchangeable anvils of different lengths. The micrometer head has a movement of 1 inch. Metric micrometers of this type are also made.

The shoulders of the anvils fit against the shoulder of the micrometer head, so as to insure accurate measurements. The anvils are held positively in place by a clamp-screw which fits a V-groove. Because of their tubular construction, these micrometers are light and easy to handle. They can be quickly adjusted and locked at any reading. The measuring points are hardened and the faces are ground to a radius, which especially adapts them to the measuring of parallel or curved surfaces.

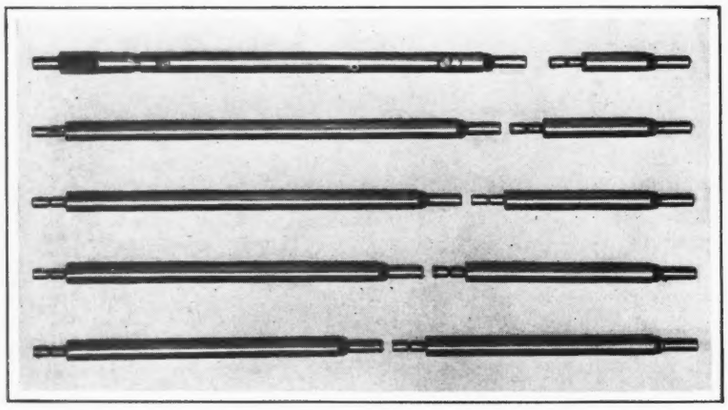


Fig. 2. Inside Micrometer of Tubular Construction, together with Ten Anvils

TRENT POT-TYPE ELECTRIC HEAT-TREATING FURNACES

A line of pot-type electric heat-treating furnaces suitable for using lead, salts and cyanide, is being introduced on the market by the Harold E. Trent Co., 439-43 N. 12th St., Philadelphia, Pa. These furnaces embody a number of features on which patents are pending. They have been designed relatively small in diameter without causing any increase in the temperature obtained on the outside of the furnace casing. It follows that if the exposed surface is less at the same temperature, the heat radiation loss must, of necessity, also be less.

Another feature of the construction, which is apparent from the illustration, is that the cover is lifted from the pot in two halves without interfering with the thermo-couple, thus making the working surface of the furnace available. Although the equipment is not recommended for higher temperatures than 1700 degrees F., it has been used at temperatures up to 1950 degrees F. without marked deterioration of the crucible.

Trent Pot-type Electric Heat-treating Furnace for Leads, Cyanide, etc.

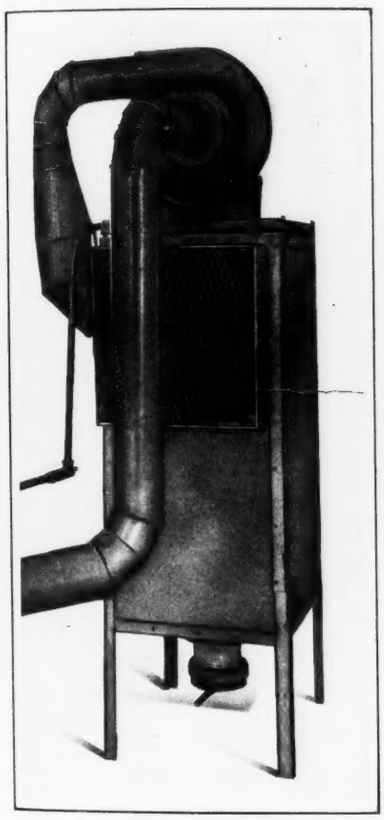
The crucible is suspended from a casting partially imbedded in the furnace above the refractories. The heating element occupies an annular cavity, the distance from the wall of the insulator to the wall of the crucible being not more than 1 1/4 inches. The heating element is supported on molded insulators which are strong enough to withstand extreme service conditions. These insulators are interlocked in position and are filled in behind with insulating powder. The heating element is rigid in its vertical members, but it is flexible so as to permit being conveniently formed around the inside of the furnace. The terminal boxes are arranged for single, two- or three-phase current, according to the size of the pot and the requirements of the installation, and for voltages of 110, 220 and 440.

MIDWEST AIR FILTERS FOR GRINDING OPERATIONS

Filters for cleaning the air discharged by grinding, buffing and polishing machines have been developed by the Midwest Air Filters, Inc., Bradford, Pa. These filters are intended for installation inside

of buildings at the end of air ducts carrying the abrasive particles from the grinding operations. One of the advantages of these filters, particularly in Northern climates, is that the filtered air can be recirculated within the building during the winter months without being reheated. Another advantage cited is that these air filters permit the breaking up of cleaning systems into a number of small systems which can be shut off when not required.

The filters have a large dust-holding capacity and permit an efficient flow of air when containing as much as 20 pounds of metal dust. The filters should be cleaned, however, after an accumulation of from 6 to 8 pounds of dust. When the dust-laden air blows into the receptacle in which the filters are installed, the heavy dust is deposited before the filters are reached, while the finer particles are carried into the filters and impinged upon the filtering medium. An effective receptacle consists simply of a chamber larger than the duct itself, where the sudden expansion of the air permits the heavier particles to drop to the bottom.



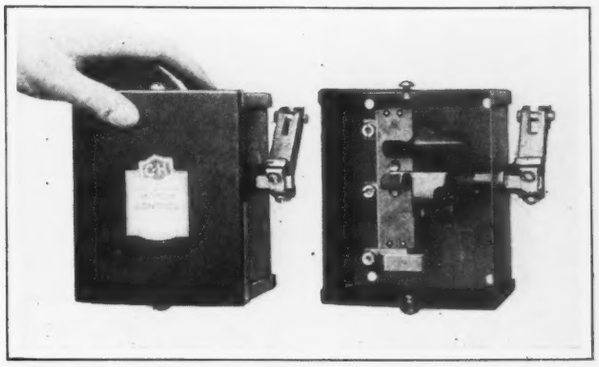
Midwest Air Filter for Cleaning Air Discharged by Grinding Machines

The size of the filter installation depends upon the number of grinding wheels used and the suction pressure. In light grinding operations, a 9-unit filter installation will handle from 15 to 20 small grinding wheels.

CUTLER-HAMMER LEVER-OPERATED MASTER SWITCH

A switch now being introduced on the market by the Cutler-Hammer Manufacturing Co., 166-12th St., Milwaukee, Wis., is intended for use as a pilot circuit-control device on lathes and other equipment where starting and stopping of the machine is to be governed by a splined shaft, shipper rod, or similar device. Low-voltage protection is one of the features. Should the motor stop, due to low voltage or for any other reason, it will not restart until the switch has been again operated. Accidents and damage to machines caused by unexpected restarts are thus eliminated.

Other features include non-stubbing contacts; a shear pin which protects the mechanism; few parts; a simple construction; an operating lever



Cutler-Hammer Master Switch Designed for Lever Operation

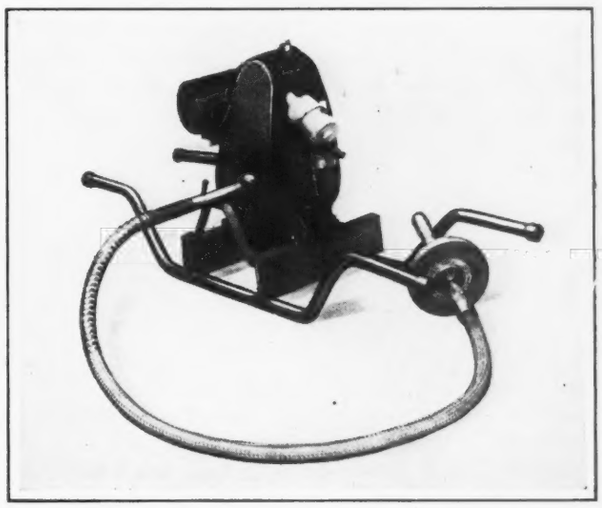
which can be placed in any one of four operating positions, 90 degrees apart, to suit installation requirements; a long, steel-to-bronze main bearing with an oil hole. The switch is of small size and is fully enclosed in a steel case the cover of which can be removed by loosening two screws.

Moving the switch into the "on" position starts the motor, the same as in pressing the "on" button of the ordinary push-button station. Throwing the switch in the opposite direction, stops the motor.

STOW GASOLINE-DRIVEN FLEXIBLE SHAFT UNIT

A portable gasoline-driven flexible shaft unit intended primarily for use wherever electric current is not available for the operation of electric-motor units, constitutes the latest addition to the products of the Stow Manufacturing Co., Inc., Binghamton, N. Y. This unit is equipped with a gasoline engine of 2.2-horsepower, which may be run at speeds adjustable from 1400 to 2200 revolutions per minute. The net weight of the equipment is 176 pounds.

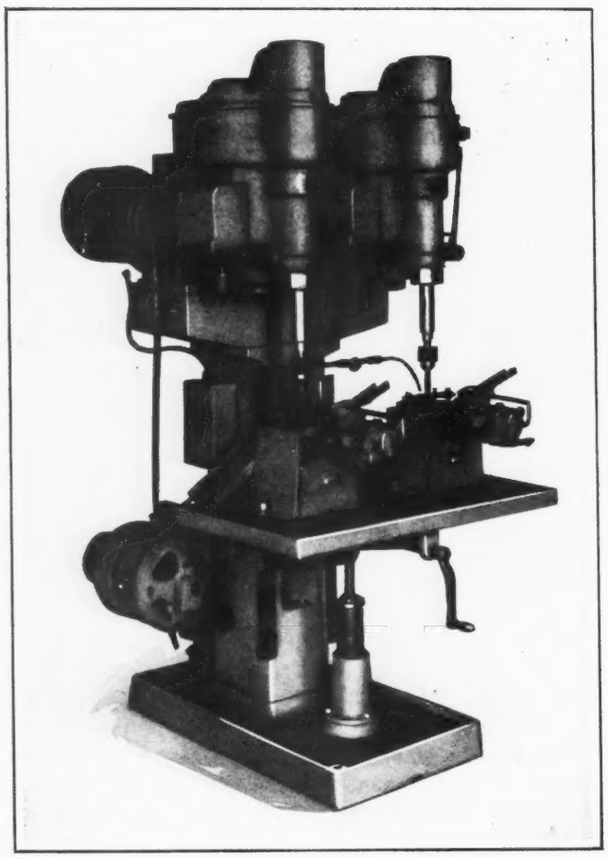
The unit is particularly useful along steam railroads, in bridge construction operations, in small foundries, etc. It may be employed in the performance of drilling, sanding, filing, grinding and other operations. A No. 5 flexible shaft 10 feet long for an 8- by 1-inch grinding wheel is provided. All standard and special attachments made by the company may be obtained for this unit.



Stow Flexible-shaft Unit Driven by Small Gasoline Engine

GATERMAN DOUBLE-SPINDLE PNEUMATIC TAPPING MACHINE

A No. 10S double-spindle heavy-duty pneumatic tapping machine recently brought out by the W. Gaterman Manufacturing Co., Franklin and 15th Sts., Manitowoc, Wis., is here illustrated. It is shown equipped with automatic feeding and ejecting fixtures for nut tapping operations. The feeding of the nuts from the magazines to the taps and their ejection at the end of the operation are accomplished by pneumatic means. This permits the mechanism to be of simple construction and provides certain flexible features.



Gaterman Double-spindle Tapping Machine

The fixtures can be easily removed so that the machine may be employed for general-purpose service, or other types of fixtures can be applied to suit the work. Equipped as illustrated, the machine will tap 3/4-inch nuts with U. S. standard threads at the rate of 1500 holes per hour, 1/2-inch nuts at the rate of 2200 per hour, etc. The weight of the machine shown is 3600 pounds.

SCHMIDGALL BORING AND MILLING TOOL

Square and irregular shaped holes of many designs may be produced in steel by means of a tool being placed on the market by C. H. Schmidgall, 307 Cass St., Peoria, Ill. The tool itself is shown in Fig. 2, while Fig. 1 illustrates typical designs that can be machined by its use in a lathe, drilling machine, milling machine or other types of machine tools.

From Fig. 2 it will be seen that the tool is provided with a pilot at the lower end, which guides the device during an operation by entering a round hole previously bored in the work. The device has two large milling cutters and two small milling cutters mounted at right angles to the former. The teeth of these milling cutters overlap, so as to insure sharp square corners in the work, but there is no driving action between the teeth.

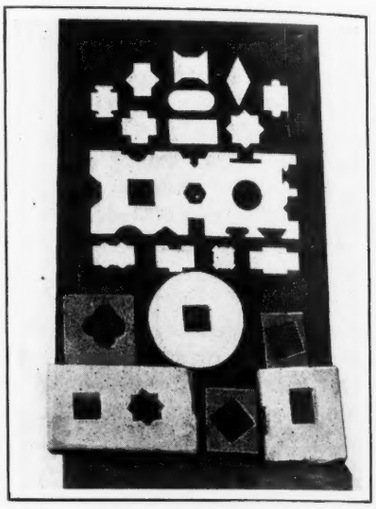


Fig. 1. Typical Designs which Can Be Produced by Means of the Schmidgall Boring and Milling Tool

The large cutters are screwed on two bevel gears that mesh with bevel pinions attached to the small cutters. Driving of the bevel gears and the bevel pinions through them, is accomplished by a second pair of bevel pinions mounted on the central driving shaft of the device. The body and the shaft for the large cutters is one piece of steel. The gears are protected from dirt by an annular flange which extends from each side of the body. Every cutter has an annular groove in one face that coincides with the corresponding flange.

By inserting black diamonds in the cutters, glass and similar hard surfaces may be bored. Various sizes of holes are obtained by merely changing the cutters. It is possible to bore spiral holes.

For boring wood, different types of milling cutters are supplied, and a wood boring tool is substituted for the pilot so that the hole is produced complete in one operation.

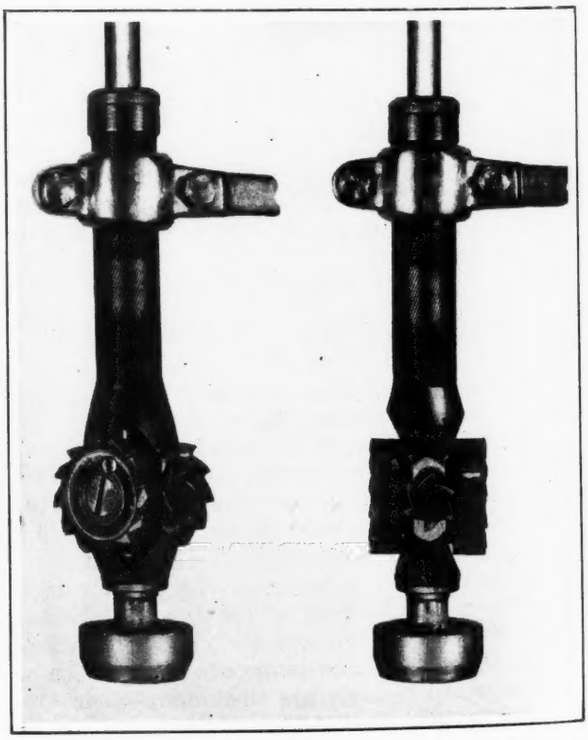


Fig. 2. Schmidgall Boring and Milling Tool for Producing Square and Irregular Shaped Holes

BOSTON GEAR WORKS REDUCERS, CHAIN DRIVES AND SHAFT HANGERS

The Boston Gear Works Sales Co., Norfolk Downs, Mass., has recently added to its products a line of type V standardized vertical speed reducers, Renold-Boston silent- and roller-chain drives, and type BF self-aligning shaft hangers. From Fig. 1 it will be seen that the speed reducers are of such a design that they can be conveniently

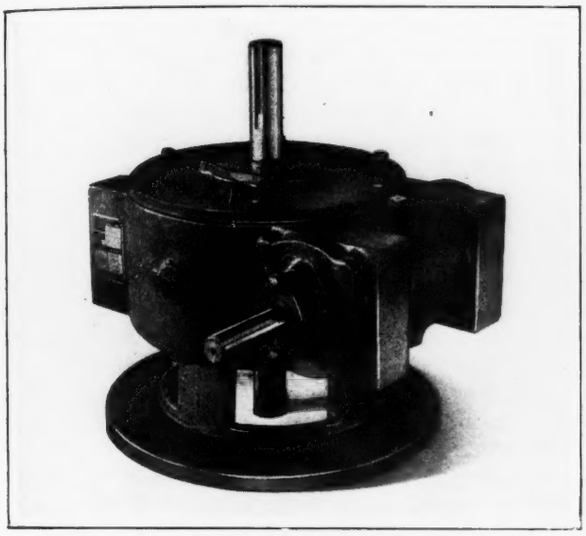


Fig. 1. Vertical Speed Reducer Brought Out by the Boston Gear Works Sales Co.

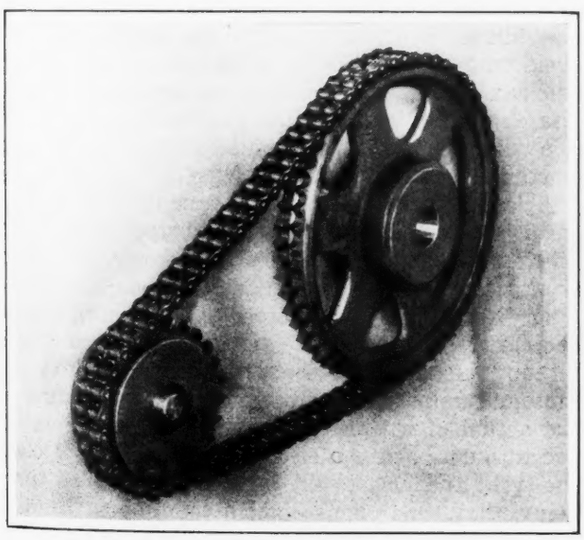


Fig. 2. Renold-Boston Duplex Roller Chain

fastened on top of a machine, to a wall, or to a floor. A driven shaft can project either above or below the unit or from both of these points. An oil-tight construction prevents any oil leakage.

The reducers are equipped throughout with Timken tapered roller bearings and are fitted with phosphor-bronze worm-gears. The steel worms, which mesh with these gears, are hardened and have ground and polished threads. These vertical speed reducers are obtainable in the same ratios as the Boston type T speed reducers.

The standardized silent- and roller-chain drives are made in various capacities from 1 to 100-horsepower. The company has brought out a book containing simplified charts, by means of which a chain user can quickly select the proper chain drive for any requirement. Fig. 2 shows a standardized duplex roller-chain with sprockets.

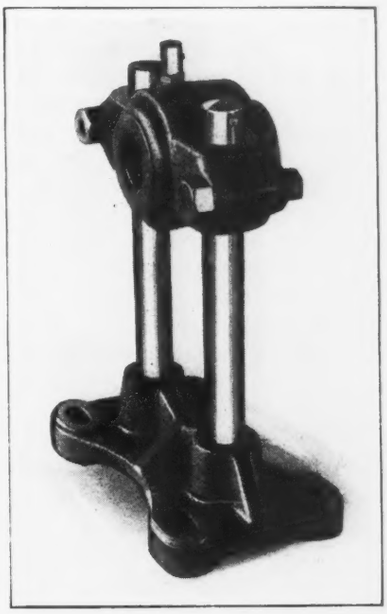


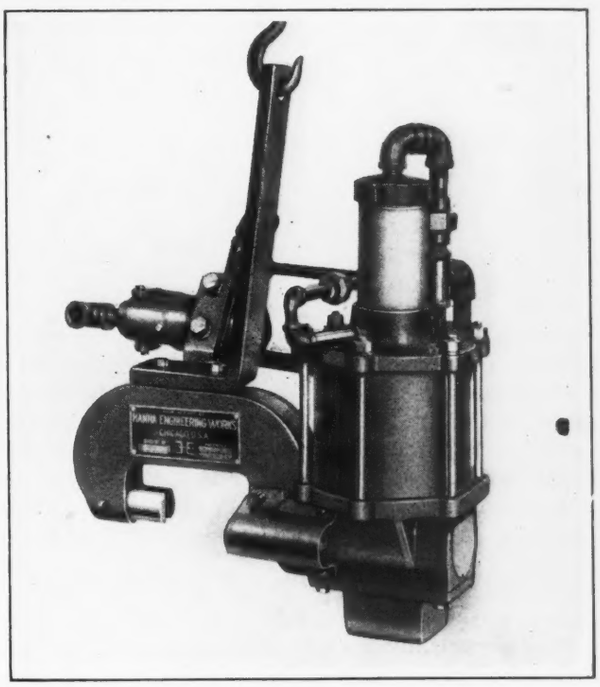
Fig. 3. Self-aligning Ball-bearing Hanger

A type BF self-aligning hanger is illustrated in Fig. 3. Hangers of this design are suitable for use as outboard bearings in connection with speed reducers and chain drives. The hangers are adjustable for height, and are so constructed that they remain rigid after an adjustment has been made. The hangers can be readily fastened to a shaft at any point. The shaft bore of the hangers is made to fractional dimensions, instead of to metric dimensions.

Any of the products described in this article can be supplied from stock by all Boston gear service stations.

HANNA PORTABLE PNEUMATIC PRESS

A portable pneumatic press which exerts a pressure of 8 tons and weighs only 95 pounds is being introduced to the trade by the Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill. The press is available in several sizes, the one illustrated hav-



Hanna Pneumatic Press which Exerts a Pressure of Eight Tons

ing a 2-inch throat depth or reach, a 6-inch gap, and a 5/8-inch die stroke. It is particularly suitable for pressing shackle pins into automobile chassis frames as the frames pass along an assembly conveyor line. The pressure exerted and the short stroke adapt the press to shackle pins which are serrated under the head, and have a threaded hole in the head which must not be marred.

The mechanism between the air piston and the die is of the roller-end-wedge type, which provides a variable leverage or pressure in close conformity to the work to be done. Low air consumption is another advantage mentioned for this equipment.

"STAYNEW" COMPRESSED AIR LINE FILTER

A filter designed to remove water, oil, rust, iron scales and other foreign matter from compressed air passing through pipes, thus reducing the wear of pneumatically operated equipment, is here illustrated. This device is a recent product of the Staynew Filter Corporation, 101 N. Water St., Rochester, N. Y. The filter itself has an aluminum housing and is enclosed by a pressed-steel housing having a flanged joint made to withstand a working pressure of 125 pounds per square inch. Shells constructed to withstand higher pressures can be supplied.

Filter for Compressed Air Lines

Air entering the top end of the steel housing is thrown against the inner wall of this housing by the shield that is assembled over the top of the filter. The downward velocity carries most of the oil, water and dirt to the bottom of the shell, while all remaining water, oil, or dirt is caught by the filter. The drain cock provides for removing water, oil and sediment from the shell. By closing a valve to shut off air going into the filter housing and opening the drain cock, the air in the outlet pipes or holes is forced back through the filter proper, removing all material collected on the filtering surface. This filter is made in six sizes.

IMPROVED PRODUCTS OF THE GENERAL ELECTRIC CO.

The electrically heated oil-tempering baths manufactured by the General Electric Co., Schenectady, N. Y., have been redesigned without changes in dimensions. The redesign simplifies periodic cleaning of the heating units and prolongs the life of the equipment. In the new design, the heating units are not fastened together under the oil; instead of being fastened to the protective apron placed over the terminals, they are fastened to the flange on the tank. To remove a burned-out unit or to remove units for cleaning purposes, it is only necessary to take out six screws which hold the protective apron in place. After removing the protective apron, the units can be taken out one at a time, by one man. The new units have a sealed terminal instead of the open porcelain type.

The General Electric Co. has also revised its line of crane protective panels bearing the designation CR-7409. Such panels provide overload and undervoltage protection for all motors of a crane, and are designed for use with an emergency switch. The principal change in the revised line is a regrouping of the units involved which has resulted in a decided reduction in total size. This is considered a distinct advantage due to the limited space in most crane cabs. Another change is the substitution of instantaneous overload relays for the former dashpot overload relays. These panels may be used with either drum switches or magnetic control panels.

An improvement has also been made in the control equipment used with General Electric automatic arc-welding heads, by means of which the feed of the electrode wire is stopped a short time before the welding current is shut off at the end of the weld. This clears the electrode from the weld and fills in the crater which is left at the end of the weld when the arc is cut off short. The electrode is clear of the weld when removing the work from the clamping fixture, thus preventing the end of the wire from dragging, which is of particular importance with large sizes of wire.

The control panel for the automatic arc-welding head is controlled by a start-and-stop push-button station. When the end of a weld is reached in an operation, the operator pushes the stop-button to open the auxiliary contactor. This, in turn, stops the electrode motor and opens the magnetic clutch circuit, thus stopping the wire feed. The line contactor remains closed for a short time, because of the action of a time-delay relay. This allows the arc to burn back the electrode sufficiently to clear the weld and also to fill in the crater. The time-delay relay then opens and, in turn, opens the line contactor, stopping the travel motor by opening the travel relay.

PORTABLE COMBINATION BLOWER AND SUCTION DEVICES

In an article published in June MACHINERY, page 805, illustrating and describing the "Super Giant" portable electric-driven combination blower and suction device made by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill., it was stated that the device may be obtained in voltages from 100 to 175. The statement should have read "voltages from 100 to 275." The "Giant" model combination blower and suction device made by the same company can be obtained in voltages from 32 to 275.

EFFECT OF PRESSURE ON LUBRICANTS

In a bulletin published by Arthur D. Little, Inc., it is mentioned that the compounding of lubricants from many different mineral, animal, and vegetable oils has been largely imperical, guided by a knowledge of the desirable viscosity or body of the oil for a given condition and the effects of temperature on the oil. There has still remained an indefinite factor which differentiated certain oils as better lubricants than others. This factor has been termed "oiliness," but until recently the reason for this superior performance of certain types of oils has been a complete mystery, and the relative value of the various oils has been much disputed.

At the lubrication session of the American Society of Mechanical Engineers last December, there was brought forward the result of certain researches that appear to have solved the problem of "oiliness." It was shown that the viscosity or body of various oils changes with pressure in a very interesting way. Those oils that are generally regarded as the best lubricants stiffen rapidly when pressure is applied to them. A number of the vegetable oils, including castor-oil, have the required increase in viscosity at low pressures, but at somewhat higher pressures they cease to show the characteristics of good lubricants. In fact, certain oils, notably the best so-called "cutting oils," are able to freeze solid, due to the application of pressure, even at temperatures many degrees above their normal freezing points. Indications are that this freezing as a result of pressure takes place even when these oils are mixed with non-freezing oils such as the mineral oils.

It may be expected, according to the bulletin quoted, that within a few years, at most, there will be a marked change in the methods of compounding lubricants and in the effectiveness of the products, especially in those fields where heavy loads and high temperatures are encountered. The better insight into the field of cutting oils will doubtless make both cheaper and better lubricants for this service. In the field of machine operations, thousands of horsepower will be saved and higher speeds realized as the result of intelligent understanding of the characteristics of various oils on which their "oiliness" depends.

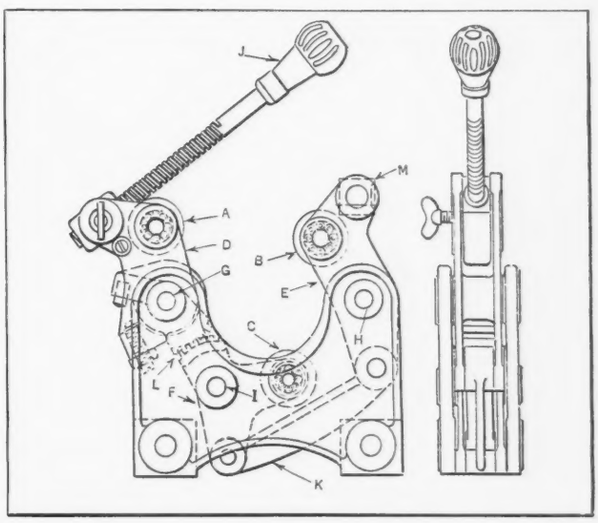
* * *

SELF-CENTERING STEADYREST

In the development of mechanical and other appliances, it is not uncommon for designers to originate, independently, devices that are fundamentally alike. The "Equalizing Steadyrest" described and illustrated on page 692 of May MACHINERY and the self-centering design here illustrated evidently are examples of independent developments which are similar in principle, although the two designs differ in regard to constructional details. The self-centering steadyrest here illustrated, however, is a patented design, and the steadyrest shown in the May number is considered an infringement by the McCrosky Tool Corporation, although we have been assured by the author of the former article that the steadyrest which he designed and described in the May number was developed entirely independently to meet a certain manufacturing requirement; moreover, the originator of this design did not know about the commercial type shown by the accompanying illustration.

This duplication of designs based on the same principle is one more example tending to show that when a certain mechanical requirement must be met, it is possible and not uncommon for experienced designers, working independently of each other, to arrive at practically the same solution, and this is doubtless because men engaged in such work have been trained to first analyze a given problem and then obtain a satisfactory solution by proceeding along logical lines.

As the self-centering steadyrest of the McCrosky Tool Corporation differs somewhat in detail from the former design, its arrangement will be described. The work is supported by three rollers *A*, *B*, and *C*. These rollers are carried by roller arms *D*, *E*, and *F*, which are free to turn about fulcrum



McCrosky Self-centering Steadyrest—Patented

pins *G*, *H*, and *I*. Roller arms *E* and *F* are connected by link *K*, and arms *F* and *D* are connected through segment gearing *L*.

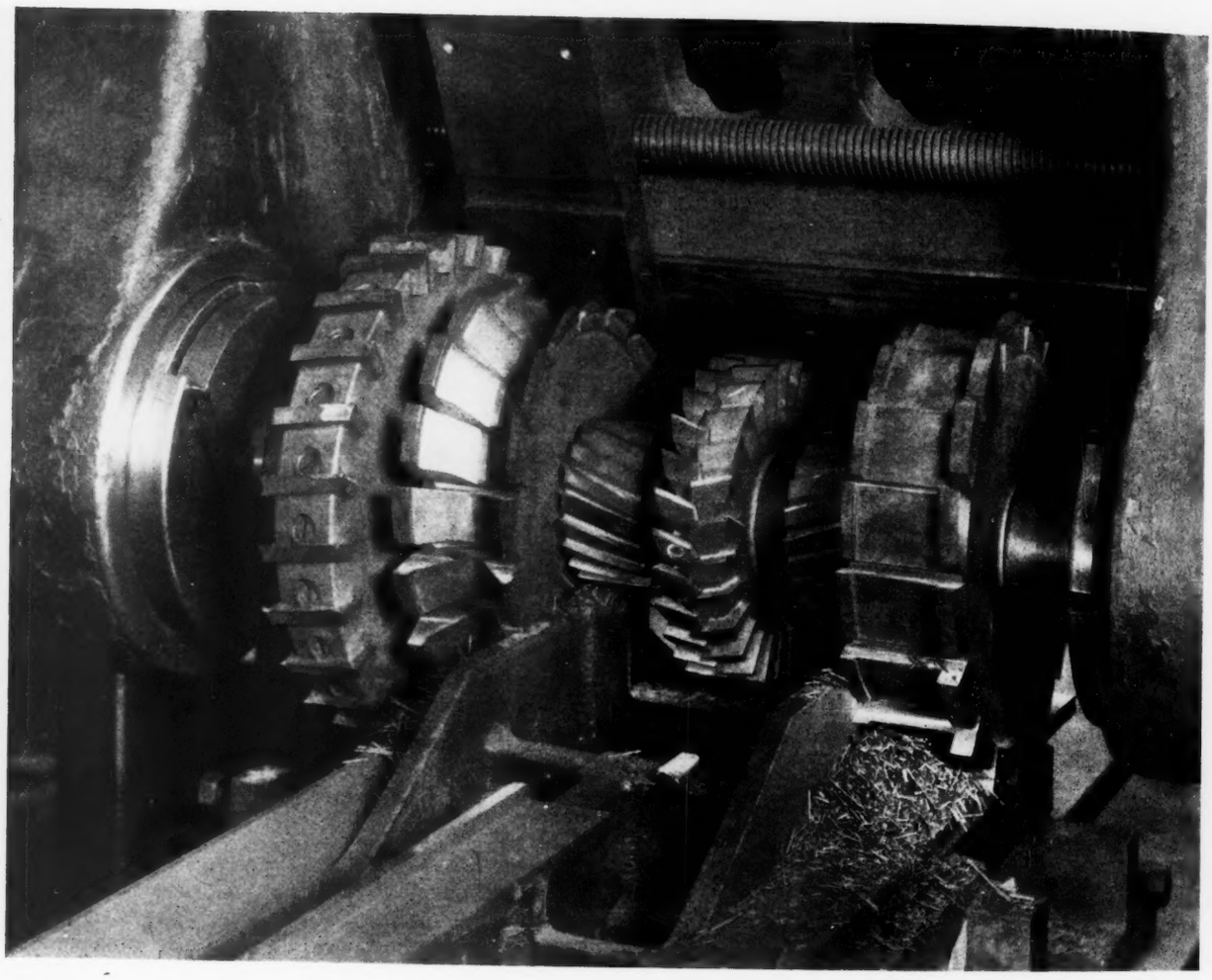
After the work is inserted, it is merely necessary for the operator to close the jaws and tighten screw *J* sufficiently to bring the rollers firmly into contact with the work. When the steadyrest is closed about the part to be turned, the three rollers move in unison toward the center, the rollers being self-centering. The tightening screw *J* bridges across the top and engages swivel block *M*. Diameters from 3/8 inch to 3 3/4 inches may be supported by this steadyrest without any adjustments, except a few turns of the tightening screw.

* * *

WELDING SOCIETY'S MEDAL

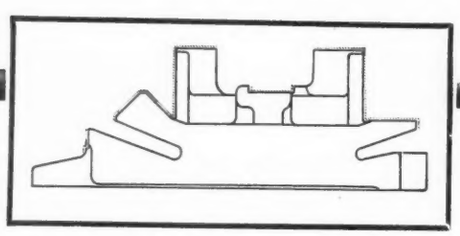
According to an announcement made by the American Welding Society, the Board of Trustees of the Samuel Wylie Miller Medal have decided that this medal may be awarded annually for any meritorious achievement which, in the judgment of the Board of Trustees, has contributed conspicuously to the advancement of the art of gas or arc fusion welding and cutting. The award for any calendar year shall be announced, and the medal, together with a suitable certificate, presented at either the annual or fall meeting of the society, as the Board of Trustees may elect.

GOOD CUTTERS SAVE



19 Surfaces Milled at a Pass—

With a cut 6 feet in length and ¼ inch deep, these cutters mill 19 surfaces at once. They do it easily and with a saving in time that reduces the cost of the part. Brown & Sharpe cutters lower real cutter costs.



TIME *and* MONEY

when you figure the Real Cost

DURING any given period of time the performances of a high grade and of an inferior cutter will differ greatly, both as to quality and quantity of work done.

The inferior cutter will require more frequent sharpenings, and frequent sharpenings increase the *real* cost of a cutter.

There is no economy in buying inferior cutters by price alone. It is not the first cost but the real cost which determines the economy of the investment.

Let our representative recommend cutters that will save you time and money by getting the maximum production obtainable from your machines. Keep a copy of Catalog No. 30 on hand for cutter reference.

BROWN & SHARPE CUTTERS
give lowest cost when you
figure Real Cost

The Cost of

Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
Plus Lost Production
Plus Sharpening Cutters
Plus Original Purchase
Equals
Real Cost of Cutters

What is the Real
Cost of Your Cutters?

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

London, June 16, 1928

Evidence is not wanting to show that the steady progress which has been noticeable in the British metal-working industries since the beginning of the present year has now been arrested. Generally conditions are not so bright as was the case a month ago, and while there is no indication of a slump, a considerable falling off in both orders and inquiries may be noted in many industries. So far, this year has followed much the same course as last, and the next few weeks should serve to indicate whether the present check is merely temporary.

Quietness in many branches of the machine tool industry is doubtless to be accounted for by the growing proximity of the Quadrennial Exhibition at Olympia, as many prospective purchasers will be delaying the allocation of orders until they have an opportunity of comparing and weighing the merits of the latest machines by the various makers. Whatever may be the position of industry as a whole, it is safe to prophesy a busy autumn for the machine tool manufacturers, who will then be working on orders booked at the exhibition.

Payment by Results in the Engineering Industry

At a conference of the National Committee of the Amalgamated Engineering Union held recently, it was decided, in view of the fact that 75 per cent of the members of the Union are already working under some system of payment by results, to recognize the system and negotiate for a national agreement of control. It is evident that such a decision could not well be further delayed, and one of the strongest arguments in favor of the system is provided by the fact that, although not officially recognized by the engineering union, it has made rapid progress in recent years. Moreover, it is evident from figures quoted by the employers that owing to the rapid transition from hourly rates to some form of piece rate, the average earnings in the industry have been considerably increased, and this has undoubtedly been an important factor in breaking down the opposition to the system on the part of the union officials.

Overseas Trade in Machine Tools

In April exports of machine tools were well above the average tonnage, but lower in ton value. The four months of this year now show an excess of 2 per cent in tonnage over the average for 1921-1924, and a fall of 1 per cent in total value. The figures for April show that 1,536 tons of machine tools were exported, valued at £156,680 with a corresponding ton value of £102. Comparing these figures with those for March and February, we find that in the former month 1,229 tons of machine tools were exported valued at £167,124, and in the latter 1,023 tons valued at £130,982.

The exports of tools and cutters have shown a slight falling off in recent months, the total value for April being given as £48,675 as compared with £50,184 in March, and £51,149 in February. Imports for April show an increase in tonnage and a slight falling off in value as compared with March.

The Automobile Industry not very Active

Regarded as a whole, conditions in the automobile industry are distinctly flat, and very few manufacturers are employed at anything like the rate that was hoped for, and which is usual at this time of the year. Some compensation is afforded by the fact that there has of late been some quickening in the demand for light cars, and firms engaged on the production of heavy commercial vehicles are working at full pressure.

There is no doubt that the tax which has recently been imposed on gasoline, together with the high horsepower tax, is having an adverse effect upon the automobile industry. If evidence of this is wanting, it is to be found in the fact that light cars, *i.e.*, those which hold the advantage both in respect of low-rated horsepower and low gasoline consumption, are mainly in demand at the present time. Still more significant are the announcements by several well-known makers that they are about to enter the market of very small cars, a market which has hitherto been almost exclusively supplied by a diminutive car of world-wide reputation.

It is evident that if the present heavy taxation is to continue, the trend of British design will be towards smaller and smaller cars. The serious point, from the manufacturers point of view, is that such cars are for the most part unsuited for the export market, so that soon the manufacturers will be in the unenviable position of either having to manufacture one type of car for the domestic and another for the export market, or else of seeing their overseas trade steadily declining.

The Iron and Steel Industry Suffers from Competition from Abroad

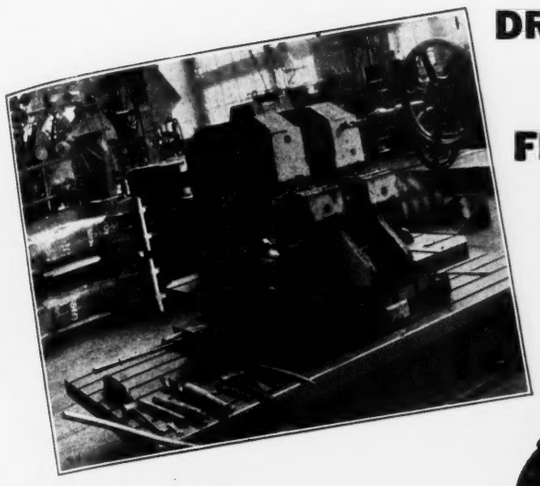
Despite a stiffening up of Continental iron and steel prices in recent weeks, Continental makers are still able to undersell British competitors in the British market. The price disparity is, however, considerably less than formerly, and with production costs continuing to rise in Germany, Belgium, and France, it is evident that foreign competition must become progressively less keen. That the industry remains depressed is due to the general paucity of demand, and this again reflects on the conditions in the heavy engineering industries.

The activities of the Central Electricity Board Commissioners, in accordance with the new Electricity Act, will insure good employment in the electrical engineering industry for some time. Thus, in connection with the Central Scotland electrification scheme, contracts to the value of £315,000 have been placed for super high-tension switch gear.

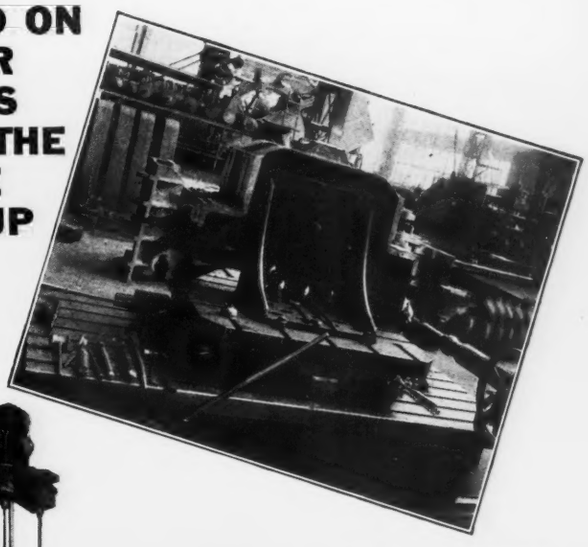
* * *

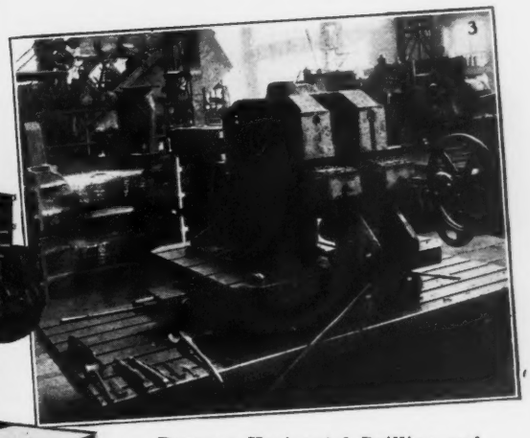
AIRCRAFT DEVELOPMENT IN 1927

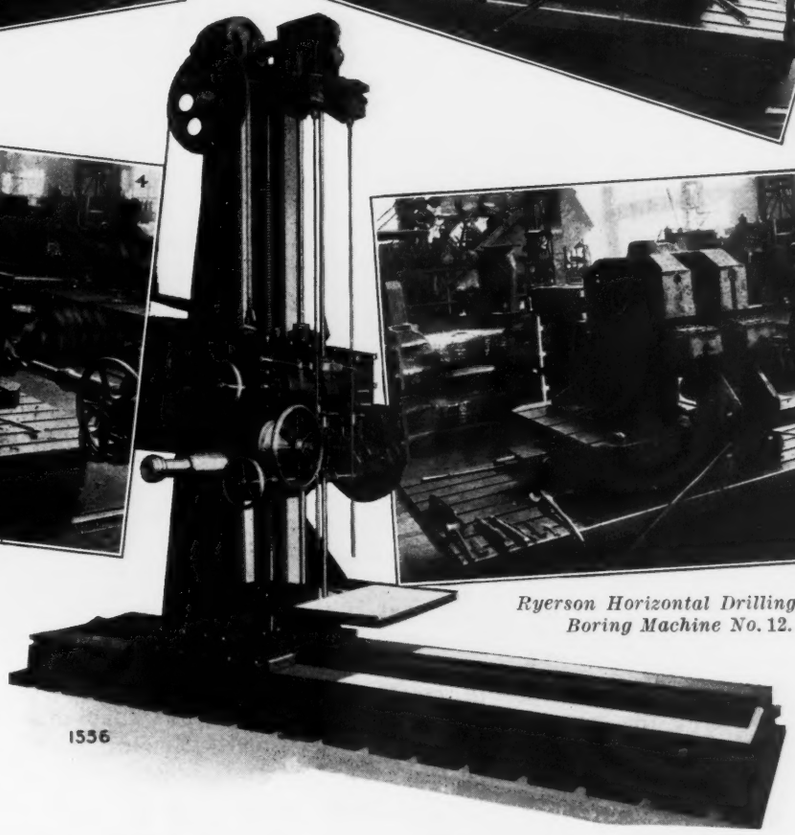
The census of aircraft manufacture for 1927 is now available. It appears that, in 1927, factories engaged mainly in aircraft manufacture built 1857 airplanes valued at over $12,000,000, and 105 seaplanes valued at $2,225,000. In 1926, 1125 airplanes and 61 seaplanes were built. Sixty-one establishments were engaged in aircraft building in 1927, located in seventeen different states. The industry gave employment to over 4300 wage earners.



DRILLED ON FOUR SIDES FROM THE ONE SET-UP







1472 lb. Steel Casting held by a bolt and strap through a hole in the center of the casting. Rear side against angle plate. Eight 1-5/16" holes drilled and back faced through 1-¼" material. Four 1-25/32" holes drilled through 1-¼" material.

Total drilling time, 4 operations, including setting from floor to floor—One Hour.

Ryerson Horizontal Drilling and Boring Machine No. 12.

Cut Your Floor-to-Floor Time

One simple set-up—then uninterrupted operation. The operator plants his feet in one spot—the work is right in front of him, and every control within easy reach. No climbing over and around odd-shaped castings all day. And you can handle anything in the shop—economically—with the Ryerson Horizontal Drills. The larger the piece the bigger the saving.

The Horizontal Drill simplifies the handling of difficult pieces. It gives you a wider range of operation and greater ease in handling the general run of work. It will show a big saving in floor to floor time.

Let us send you the facts—Ask for Bulletin B-4051

JOSEPH T. RYERSON & SON INC.

ESTABLISHED 1842

Chicago Milwaukee St. Louis Cincinnati Detroit Cleveland Buffalo Pittsburgh Philadelphia Boston Jersey City New York
Richmond Houston Tulsa Dallas Los Angeles San Francisco Denver Minneapolis Duluth

Drill it Horizontally

RAILWAY EXHIBITION AND CONVENTION

The exhibition of railway equipment, tools and accessories held in connection with the annual meeting of the Mechanical Division of the American Railway Association, and the annual convention of the Railway Supply Manufacturers' Association at Atlantic City, June 20 to 27, was one of the largest ever held in connection with any railway convention. There were, in all, 380 exhibitors making use of 130,000 square feet of exhibition space. The exhibits filled not only the Million Dollar Pier but also the new exhibition building erected by the authorities of Atlantic City, which was used in conjunction with the pier for exhibition purposes.

While the number of exhibitors, as mentioned, was 380, this refers merely to the exhibits separately entered. The number of firms having products on exhibition was much greater than this, as in many cases, dealers exhibited the products of the several firms that they represent. While the machine tool exhibits were not as extensive as formerly, several machine tool manufacturers were represented, and the number of makers of metal-cutting tools and shop equipment was quite large. The machine tools shown were such as are of special application to railroad shops. Some were of the single-purpose type intended exclusively for operations in locomotive shops. The machine tools shown were practically all in operation, a fine demonstration being made of their power, rigidity, and method of application to railroad work.

Practically all of the shop equipment on exhibition has been illustrated and described in MACHINERY during the past year, and there is, therefore, no need of a detailed description of the exhibits at this time; but it might be mentioned that if the railroad shop could take advantage of the improved equipment shown at the exhibition, there would, doubtless, be a very great increase in the efficiency, and a reduction in the cost of the work done in railroad repair shops.

In connection with the exhibition of metal-cutting tools, there were also many actual demonstrations to show their application and capacity for cutting metal.

* * *

LATHE BUILDERS ADOPT GUARANTEE AND SERVICE CLAUSE IN CONTRACTS

The lathe group of the National Machine Tool Builders' Association has adopted a standard guarantee clause, effective July 1, according to which the machine tool company guarantees each machine tool built by it "to be free from defective material or workmanship for a period of six months from date of shipment from its works, when given normal and proper usage, and when owned by the original purchaser."

To discourage unwarranted demands for service, this same group of manufacturers has also adopted the following clause which will be included in all sales contracts after July 1: "Should the purchaser of any machine built by this company desire an erector or demonstrator to come to his plant to either erect, service, or demonstrate a machine, such service will be rendered at a specified charge per day, plus all other expenses incident thereto, including railroad fare, hotel bills, etc."

The rate charged for a service man is a matter of individual decision, but a survey of the practice in the machine tool and other mechanical industries shows that the usual rate charged is $15 per day and expenses.

In announcing the adoption of these contract clauses, the National Machine Tool Builders' Association, through its general manager, Ernest F. DuBrul, makes the statement that the association recognizes that fair-minded and competent users of machine tools do not make unfair service demands, but that the practice of a few buyers, who make unreasonable demands for service and repairs, have made it necessary to adopt these regulations as a reasonable restriction on such practice. It is recognized that in satisfying demands of this kind, the fair-minded buyer is discriminated against, because if such service is rendered without a separate charge, he has to help to pay for service that he himself neither asks for nor requires. Therefore, those who need such service ought to pay for it themselves.

* * *

AUTOMOTIVE ENGINEERS' SUMMER MEETING

Nine technical sessions were held during the summer meeting of the Society of Automotive Engineers in Quebec, June 26 to 29. For the first time since 1913, the Institution of Automobile Engineers of England sent a delegation, headed by its president, E. G. E. Beaumont, to attend the meeting of the Society of Automotive Engineers.

The French engineer, D. Sensaud de Lavaud, came from Paris to present two papers, one on his new automatic transmission and another on synchronism of the front wheels of a car. A previous paper by Mr. de Lavaud, on independently sprung front wheels as a remedy for shimmy, was presented at the society's annual meeting in Detroit.

At the Canadian session R. S. Laughlin, president of the General Motors of Canada, made an address, and a member of the Royal Canadian Air Force told, in an illustrated talk, about the use of the airplane in Canadian exploration. Methods of obtaining more power from automobile engines were discussed at the engine session by T. J. Litle, of the Marmon Motor Car Co., a past-president of the

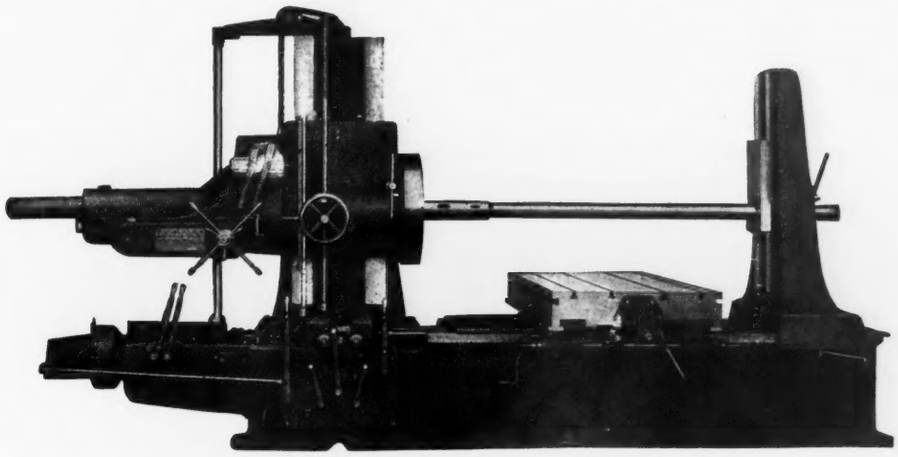
In the research session, reports were made on research work in headlighting, fuels, and engine indicators, by H. H. Allen and H. K. Cummings, of the Bureau of Standards, and E. J. Martin and D. F. Caris, of the General Motors laboratories.

Front-wheel drive, interest in which has been revived by the success of this type of construction in racing cars, was reviewed in an address by Herbert Chase, of the Erickson Co.

* * *

The Pressed Metal Institute, with headquarters at 232 Delaware Ave., Buffalo, N. Y., held its June meeting Thursday, June 7, at the Toledo Club, Toledo, Ohio. The Light Stampings Group and the Heavy Stampings Group met separately in the forenoon and discussed matters of common interest. In the afternoon, the groups met in a general meeting, and were addressed by William B. Calkins, general purchasing agent of the Willys-Overland Co., Toledo, Ohio.

QUANTITY WITH QUALITY



The new model, larger sizes of the

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine with 4 inch and 5 inch spindles,

because of their greater rigidity and power are capable of taking heavier cuts at faster speeds and coarser feeds, without sacrifice of accuracy. This, together with provision for easier manipulation, means lessened machining time.

Set-up and handling time are also greatly reduced by the single set-up on this versatile machine, for boring, drilling and milling operations in accurate relation.

WE ALSO MAKE THE

LUCAS POWER Forcing Press

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U. S. A.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, Societe Anonyme Belge, Alfred Herbert, Brussels. Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

NATIONAL MACHINE SHOP PRACTICE MEETING

The Machine Shop Practice Division of the American Society of Mechanical Engineers will hold a national meeting on machine shop practice in collaboration with the Cincinnati Section of the Society, September 24 to 27. Tentative plans for the meeting have been announced by L. C. Morrow, chairman of the division, as follows: Those attending the meeting will embark on a river steamer at Cincinnati at noon on Monday, September 24. Technical sessions will be held on board the steamer, where those taking part in the meeting will remain overnight. Tuesday morning, September 25, will be spent at Ashland, Ky., where the continuous sheet rolling mill of the Armco plant will be inspected. Technical session will be held on the boat later that day, and the participants will arrive in Cincinnati Wednesday morning, September 26, where they will adjourn to the Engineers Club for the third technical session. In the afternoon of that day, plants in Cincinnati will be visited. Thursday will also be devoted to plant visits in Cincinnati and vicinity.

The technical program has not as yet been fully completed, but announcement of this will be made at an early date. Those interested may communicate with the headquarters of the Society, 29 W. 39th St., New York City.

* * *

THE NATIONAL METAL EXPOSITION

In conjunction with the annual convention of the American Society for Steel Treating to be held at Philadelphia, Pa., October 8 to 12, the Tenth National Metal Exposition will be held. The exposition will be held in the Commercial Museum in Philadelphia, where ample exposition facilities are available. In conjunction with the convention of the American Society for Steel Treating, the American Welding Society and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers will hold meetings in Philadelphia during the week of the exposition. Further information may be obtained by addressing the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio.

* * *

EXPORTS OF INDUSTRIAL MACHINERY

The total value of industrial machinery exports for the five months ending May 31 continued to be well in advance of the corresponding exports of industrial machinery during 1927. The total exports for the five-month period considerably exceeded $60,000,000 for industrial machinery of all kinds. Of this, metal-working machinery accounts for nearly $10,000,000, the exports during April (the last month for which complete figures are available) being $2,311,942. Among the exports for the five-month period mentioned, lathes show an important gain, the value of the exports of different types of lathes being $1,247,000.

* * *

There are at the present time 2,897,000 commercial vehicles in the United States. The passenger cars now number over 20,000,000.

THE COMING LEIPZIG FAIR

The Leipzig Fall Fair, the largest general trade exposition in the world, will be held this year from August 26 to September 1. In all, there will be some 10,000 exhibits housed in nearly 100 special exposition buildings. Of these exhibits about fifty come from the United States. The exposition covers practically every product of modern industry. Further information may be obtained from the Leipzig Trade Fair, Inc., 11 W. 42nd St., New York City. The large annual machinery exposition at Leipzig is held in the spring of each year.

* * *

PERSONALS

THOMAS B. FRANK, treasurer of the Cincinnati Planer Co., Cincinnati, Ohio, has been elected a director of the National Association of Cost Accountants.

CHARLES E. TULLAR has been appointed manager of the patent department of the General Electric Co., Schenectady, N. Y. Mr. Tullar, who has been assistant manager of the department, succeeds the late A. D. Lunt.

JOHN D. HURLEY, president of the Independent Pneumatic Tool Co., Chicago, Ill., will sail for Europe July 12. While there, Mr. Hurley will visit the company's foreign branches, returning to America about the latter part of September.

ELMER A. SPERRY, chairman of the board of directors of the Sperry Gyroscope Co., Brooklyn, N. Y., has been nominated president of the American Society of Mechanical Engineers for 1929, as announced by the nominating committee of the society.

W. PARKER, director of sales of British Furnaces, Ltd., which firm represents the Surface Combustion Co., Toledo, Ohio, throughout Great Britain, has recently been traveling in the United States studying new types of furnaces used by different industries in this country.

GEORGE T. CHAPMAN, who has been with the Union Switch & Signal Co., Pittsburgh, Pa., as designing engineer, is now with Barnes Gibson Raymond, Inc., Detroit, Mich., where he will specialize on the design of automatic machinery and tools for the manufacture of springs of different types.

J. V. MOORE, formerly with the Simonds Saw & Steel Co., is now representing the Billings & Spencer Co., Hartford, Conn., manufacturer of wrenches, hammers, pliers, clamps, dogs, etc., in Pennsylvania, Delaware, and New Jersey. Mr. Moore will make his headquarters at the Leister House, Huntingdon, Pa.

LOUIS E. NELSON, until recently division superintendent of the Warner Corporation, Muncie, Ind., is now connected in a sales engineering capacity with the City Machine & Tool Works and the National Broach Co., Dayton, Ohio. Mr. Nelson will specialize on the Peerless gear tooth chamfering machine and the Bolender gear grinding chuck.

H. O. COE has been appointed manager of the Cleveland office, 403 Erie Building, of the United States Electrical Tool Co., Cincinnati, Ohio. Mr. Coe was in the sales division of the W. Bingham Co., Cleveland jobbers, for eight years, and for six years previous to that was engaged in the retail hardware business under the name of Coe & Bacher.

NORMAN F. ROBERTSON has been elected president of the John Robertson Co., Inc., 133 Water St., Brooklyn, N. Y., manufacturer of hydraulic presses and pumps. Mr. Robertson succeeds his father, the late Norman A. Robertson, who died May 24. Norman F. Robertson has been secretary of the company since 1924. Allan R. Hardie, treasurer of the company, has been made secretary and treasurer.

J. WOHLFELD, of the J. Wohlfeld Tool Design & Sales Co., production engineers, Detroit, Mich., formerly connected with various automotive and tool companies, has been appointed exclusive sales representative of the Siewek Tool & Die Co., Detroit, Mich., manufacturer of Siewek rapid safety drill jigs. The Universal Standard Co. of Detroit, Mich., has also appointed him exclusive distributor of their products, with offices at 10228 Woodward Ave., Detroit, Mich.

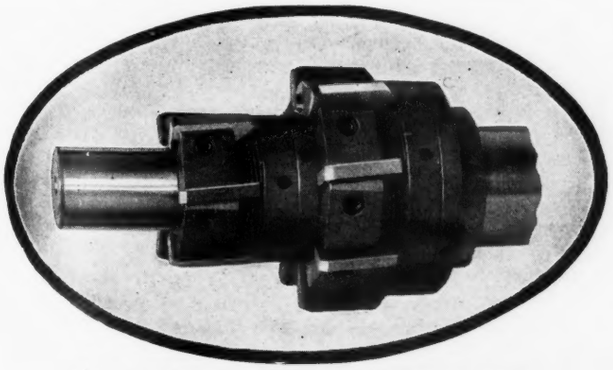
A distinctive feature of this Wetmore Shell Reamer is the ⅛" projection of the blades over the end of the reamer body for chip clearance. This allows the chips to fall off ahead of the reamer body and prevents chips from clogging up along cutting edge of blades.

Wetmore Shell Reamers have .087" adjustment oversize. Made in these sizes: 1¼" to 3", 6 blades; 3-1/16" to 5", 8 blades; 5-1/16" to 6", 10 blades. Larger sizes made on order. Made also with straight hole, if desired. Sizes above 1¾" readily adaptable for line reaming.

Why Big Plants Specify WETMORE Shell Reamers

More than one user has told us that Wetmore Shell Reamers have done work they thought would be too much for any reamer.

But Wetmore Reamers have the habit of making good on hard jobs. We guarantee them to lower your production costs. They do faster work; they stand up longer; blade replacement costs are lower.



Above is shown how Wetmore Shell Reamers can be adapted for pilot reaming in combination or single.

Wetmore Shell Reamers are adaptable for either line or pilot reaming. Body, lock nut, and cone nut are finest alloy steel, heat-treated. Left-hand angle blades are staggered to eliminate chattering.

Send for Catalog No. 26

—showing the full line of Wetmore adjustable reamers, and reduced prices. Sent free—postpaid.

WETMORE REAMER CO.

60—27th St., Milwaukee, Wis.

WETMORE ADJUSTABLE REAMERS

"THE BETTER REAMER"

J. HARRY GRUVER. 210 W. Lexington St., Baltimore, Md., the original patentee of the hollow metal balls formerly manufactured by the Hollow Ball Co., Inc., Baltimore, Md., has acquired all the patents, foreign and domestic, for the hollow seamless metal balls "known as Holbols." Mr. Gruver is now engaged in equipping a plant for the manufacture of hollow balls in various sizes, materials, and grades, and in the near future will market "Holbols" for pump and valve purposes.

ALVAN MACAULEY, president of the Packard Motor Car Co., Detroit, Mich., was elected president of the National Automobile Chamber of Commerce at its annual meeting in New York, June 7, succeeding ROY D. CHAPIN, chairman of the Hudson Motor Car Co., who was formerly president of the chamber. Mr. Macauley has been a director of the National Automobile Chamber of Commerce for many years, and is also chairman of its street traffic committee and a member of its taxation and rubber committees.

F. C. ALLEN, JR., has become president of the Allen Air Appliance Co., Inc., making his headquarters at the New York office of the company in the Grand Central Terminal Building, New York City, the main office and plant of the company being at Glens Falls, N. Y. The products of the Allen Air Appliance Co. include a complete line of turbo or centrifugal blowers and exhausters for many industrial applications, including gas- and oil-fired furnaces. The company also manufactures a complete line of stationary and heavy-duty portable vacuum cleaners for factories and power plants.

SAMUEL A. CURRY has been appointed superintendent of inspection and test at the South Philadelphia Works of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Curry, who was field engineer and turbine test engineer, will fill the position made vacant by the death of John T. Snyder, who was recently killed in an accident. Mr. Curry has been connected with the company for more than twenty-six years, having worked his way up through the ranks from a position in the drafting department to his present place. U. A. TADDIKEN, formerly a member of the condenser engineering department, will fill the position made vacant by Mr. Curry. Mr. Taddiken has been connected with the company since 1914.

OBITUARIES

WILLIAM T. HOLMES, vice-president of the Monitor Controller Co., Baltimore, Md., died at his residence in that city Saturday, June 9, at the age of fifty-one years. Mr. Holmes was born in Philadelphia, and had been associated with the Monitor Controller Co. for about twenty-five years. For the last ten years he was vice-president of the company. He was a noted engineer in his field, and took a particularly active part in the development and application of current-limit control and time-limit control systems.

NORMAN A. ROBERTSON, president of the John Robertson Co., 133 Water St., Brooklyn, N. Y., hydraulic press manufacturer, died May 24, at his summer home at Spring Lake, N. J., after a short illness. Mr. Robertson was born in Brooklyn in 1870, the son of the late John Robertson, who founded the company bearing his name. He was graduated from the Brooklyn Polytechnic Institute and immediately after entered the employ of the company with which he was associated for forty years. Mr. Robertson was well known in the electrical cable, rubber hose, blue lead and metal-working industries, for which he developed and built much special machinery.

JOHN B. THOMAS, who has been identified with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for the last fifty-two years, died recently at his home on Thomas Boulevard, Pittsburgh, Pa. At the time of his death he was assigned to special duty with the company. Mr. Thomas was born in Wales, October 6, 1852. He entered the employ of the Westinghouse organization in February, 1876. In 1886 he was sent by George Westinghouse to Paris to manage the French branch of the Westinghouse Air Brake Co. He returned to this country in 1888, and was then transferred to the Westinghouse Electric & Mfg. Co., with which firm he remained until his death.

EDMUND D. GARFIELD, for many years connected with the firm of Manning, Maxwell & Moore, Inc., died of pneumonia on June 5 while on a business trip to St. Paul. Mr. Garfield was born in Keesville, Essex County, N. Y., and was fifty-four years old at the time of his death. He entered the service of Manning, Maxwell & Moore, Inc., in 1904, and for a considerable period was manager of the Milwaukee office, where he developed a wide acquaintance among the industrial and railroad interests in the northwest. Later, the Milwaukee office was consolidated with the Chicago office, and since that time Mr. Garfield has been acting as special railroad representative of the company, with headquarters in Chicago.

TRADE NOTES

LINDE AIR PRODUCTS CO. has opened a new district sales office at 48 W. McLemore Ave., Memphis, Tenn. H. N. Smith will be district manager in charge.

BEEHLER STEEL PRODUCTS CO., manufacturer of steel, brass, and aluminum stampings in all finishes, has moved into larger quarters at 1500 Kingsland Ave., St. Louis, Mo.

HILL-CURTIS CO., manufacturer of polishing and grinding machinery, is erecting a new plant of modern construction located at Douglas Ave. and Michigan Central Railroad, Kalamazoo, Mich.

AMERICAN LEAD PENCIL CO. has removed its executive offices from 220 Fifth Ave., New York City, to 500 Willow Ave., Hoboken, N. J., where the company has recently erected a modern fireproof factory and office building.

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill., has appointed the Superior Supply Co., Bluefield, W. Va., representative for the sale of Ideal commutator resurfacers and other maintenance equipment in the Bluefield territory.

GEARS AND FORGINGS, INC., Cleveland, Ohio, manufacturers of gears, forgings, speed reducers, and special machinery, has appointed Potter & Dugan, Inc., Erie County Bank Building, Buffalo, N. Y., as district sales representatives for Buffalo and vicinity.

FULTON IRON WORKS CO., 1259 Delaware Ave., St. Louis, Mo., has purchased the Foos Engine Co. of Springfield, Ohio, manufacturer of Diesel engines of from 60 to 300 horsepower, according to an announcement made by Harry J. Steinbreder, president of the Fulton Iron Works Co.

BOTFIELD REFRACTORIES CO., Swanson and Clymer Sts., Philadelphia, Pa., manufacturer of "Adamant" firebrick cement, announces that the distribution of its products will be handled for the vicinity of Toledo by the Builders & Industrial Supply Co., 4090 Detroit St., Toledo, Ohio.

FOOTE BROS. GEAR & MACHINE CO., 232-242 N. Curtis St., Chicago, Ill., has appointed Woodbury & Wheeler, 55 Second St., Portland, Ore., to represent the company in Portland and vicinity. The Cunningham Electric Co., 2123 Pacific Ave., Tacoma, Wash., will handle the Foote Bros. line in Tacoma and vicinity.

MAGNETIC MFG. CO., Milwaukee, Wis., has appointed J. H. Phinney exclusive representative in the eastern part of Michigan, with headquarters at Detroit, for the complete line of magnetic separation equipment and magnetic clutches for power transmission made by this concern. Mr. Phinney's office is located at 420 U. S. Mortgage Building.

BLACK & BIGELOW has been organized at 551 Fifth Ave., New York City, to render engineering and business service to aircraft operators, manufacturers, and others interested in aviation. Archibald Black is president and general manager of the firm; Anson A. Bigelow is vice-president; George M. Pynchon, Jr., is treasurer; and J. Harlin O'Connell is secretary.

NORTHERN ENGINEERING WORKS, Detroit, Mich., manufacturers of cranes and hoists, have appointed the Interstate Supply Co., Commercial Trust Building, Philadelphia, Pa., direct factory representative for the Philadelphia district, with W. H. Beyer in charge. Mr. Beyer was connected with the Philadelphia office of Manning, Maxwell & Moore, Inc., for twelve years.

MIDWEST LOCOMOTIVE WORKS, Cincinnati, Ohio, has been taken over by the owners of the Columbia Machine Tool Co. and the Ceramic Machinery Co. of Hamilton, Ohio, and will be operated as a division of these two companies. The business has been moved to Hamilton, where locomotives of from 3 to 15 tons capacity will be manufactured from designs heretofore built in Cincinnati.

This draw bar yoke 1 3/8" thick 5" wide punched and gibbed in one stroke.

Reliability and Low Maintenance a Particular Advantage

THIS 4" Ajax Forging Machine, installed in 1906, in the Macon Shops of the Central of Georgia Railway, has been in continual operation over this 22 year period and is still rendering efficient service with but abnormally low maintenance costs.

Experienced forge men, familiar with the severe nature of forging machine work, will recognize this as remarkable performance.

Since the time this machine was built, Ajax design and construction have advanced so that the Heavy Duty Machines of today have little in common with this old veteran, but in this advance have not been lost the simplicity and ruggedness which established this 22 year reliability record.

Extreme simplicity, liberal proportions, few working parts and few operating adjustments are as characteristic of Ajax Machines today as they were 20 years ago. Under present day demands for dependable, high and economical forging production, it will pay you to investigate Ajax **reliability** and **low maintenance costs** when you consider a forging machine.

THE AJAX MANUFACTURING COMPANY

Euclid Branch P. O.
Cleveland, Ohio

621 Marquette Bldg.
140 So. Dearborn St.
Chicago, Ill.

1369 Hudson Terminal
50 Church St.
New York City

AJAX

PONTIAC TRACTOR CO., 2842 W. Grand Boulevard, Detroit, Mich., announces the placing on the market of a new mounting for the standard "Stable Arc" welders built by the Lincoln Electric Co., Cleveland, Ohio. The welder unit with its stabilizer and panel are mounted on a frame which is attached to either a McCormick-Deering or a Fordson tractor. Power is taken from the tractor to drive the welder.

HOLLAND FURNACE CO., Holland, Mich., announces the establishment of the Holland Institute of Thermology to conduct researches into various phases of the relation of humidity, temperature, and circulation of air upon personnel health and efficiency. The institute, which has been founded by A. H. Landwehr, president of the Holland Furnace Co., will attempt to solve some of the heating and ventilating problems in the construction industry and the effect of humidity upon various industrial products and on the efficiency and working conditions in shops and offices.

ARMSTRONG MFG. CO., Bridgeport, Conn., manufacturer of dies, cutters, etc., announces a change in the management of the company. Frederick S. Ashmun, a grandson of Frank Armstrong, who founded the business in 1869, is secretary and treasurer. B. I. Ashmun, the father of Frederick S. Ashmun, who has been continuously associated with the business since 1893, is president. Leslie H. Taylor has been placed in charge of sales for the Middle West. An office has been opened at 9 S. Clinton St., Chicago, Ill. It is also announced that the New York sales and general export offices of the company have been moved from 181 Lafayette St. to 27 Cleveland Place (corner of Spring and Lafayette Sts.).

SIMONDS SAW & STEEL CO., Fitchburg, Mass., announces that Alvan T. Simonds, president of the company, has offered $1500 in prizes for the best essays on the subject "Reducing the Cost of Distribution." One prize of $1000 will be paid to a business executive for the best essay submitted. Another prize of $500 will be paid to a senior in college or to a graduate student or to an instructor of less than assistant professor grade, for the best essay on the subject. Competing papers should be in the hands of the managing director of the American Management Association, 20 Vesey St., New York City, on December 31, 1928. Complete information may be obtained either from the American Management Association or from the Simonds Saw & Steel Co., Fitchburg, Mass.

VEEDER MFG. CO., Hartford, Conn., manufacturer of small counting machines and die-castings, and the ROOT CO., Bristol, Conn., manufacturer of heavy-duty counters, hinges, and stampings, have united in a merger which will be known as VEEDER-ROOT, INC. John T. Chidsey, formerly president of the Root Co., has been made president and general manager of the new company. David J. Post and Curtis H. Veeder, sole owners of the Veeder Mfg. Co., expect to retire from active business, but will remain for a time with the new company in an advisory capacity. Graham H. Anthony, formerly vice-president of the Allen Mfg. Co., Hartford, Conn., will be vice-president in charge of production. Ralph C. Coxhead, formerly of the Ralph C. Coxhead Corporation, New York, will be vice-president in charge of sales. J. H. Chaplin, vice-president in charge of sales of the Root Co., will be sales manager of Veeder-Root, Inc.

COMING EVENTS

AUGUST 27-29—Regional meeting of the American Society of Mechanical Engineers at St. Paul-Minneapolis, Minn. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

AUGUST 29-SEPTEMBER 3—Eleventh Annual Conference on Human Relations in Industry at Silver Bay, Lake George, N. Y. Fred H. Rindge, Jr., executive secretary, 347 Madison Ave., New York City.

SEPTEMBER 4-7—Canadian Steel and Power Show, University of Toronto Arena, Toronto, Ontario, Canada. Campbell Bradshaw, secretary, 24 Front St. West, Toronto.

SEPTEMBER 5-22—Fourth Machine Tool and Engineering Exhibition to be held at Olympia, London, England.

SEPTEMBER 12-14—Annual convention of the American Railway Tool Foreman's Association in Chicago, Ill.; headquarters, Hotel Sherman. Secretary and treasurer, F. A. Armstrong, 564 W. Monroe St., Chicago, Ill.

SEPTEMBER 17-20—Second national meeting of the Fuels Division of the American Society of Mechanical Engineers to be held in Cleveland, Ohio. Chairman of Fuels Division, Victor J. Azbe, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

SEPTEMBER 24-27—National Machine Shop Practice meeting of the American Society of Mechanical Engineers in conjunction with the Cincinnati Section of the society. L. C. Morrow, Tenth Ave. and 36th St., New York City, chairman of the Machine Shop Practice Division of the A.S.M.E.

OCTOBER 8-12—Tenth National Metal Exposition held under the auspices of the American Society for Steel Treating at the Commercial Museum, Philadelphia, Pa. For further information, address W. H. Eisenman, National Secretary, 4600 Prospect Ave., Cleveland, Ohio.

OCTOBER 11-13—Semi-annual meeting of the American Gear Manufacturers' Association at the Hotel Statler, Buffalo, N. Y. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

NOVEMBER 22-23—Production meeting of the Society of Automotive Engineers at Hotel Book-Cadillac, Detroit, Mich. Chairman of Technical Program Committee, E. P. Blanchard, Bullard Machine Tool Co., Bridgeport, Conn.

DECEMBER 3-7—Annual meeting of the American Society of Mechanical Engineers to be held in the Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

DECEMBER 3-8—National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City.

JANUARY 14-18, 1929—Western Metal Congress and Western States Metal and Machine Tool Exposition at Los Angeles, Cal., under the auspices of the American Society for Steel Treating; headquarters, Shrine Auditorium. Secretary, W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio.

SOCIETIES, SCHOOLS AND COLLEGES

MICHIGAN COLLEGE OF MINING AND TECHNOLOGY, Houghton, Mich. Bulletin for 1927-1928, containing announcement of courses for 1928-1929.

TOWNE SCIENTIFIC SCHOOL, University of Pennsylvania, Philadelphia, Pa. Circular announcing a one-year course in fuel engineering opening October 1.

TEMPLE UNIVERSITY. Broad St. and Montgomery Ave., Philadelphia, Pa. Annual catalogue for 1928, containing calendar, outline of courses, and other information relating to the university.

NEW BOOKS AND PAMPHLETS

ELIMINATION OF WASTE (Roller Bearings). 14 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Simplified Practice Recommendation No. 67 of the Bureau of Standards.

EMBRITTLEMENT OF BOILER PLATE. By Samuel W. Parr and Frederick G. Straub. 71 pages, 6 by 9 inches, 23 illustrations. Bulletin No. 177 of the Engineering Experiment Station. University of Illinois. Urbana, Ill. Price, 40 cents.

PATENT LAW FOR THE INVENTOR AND EXECUTIVE. By H. A. Toulmin, Jr. 288 pages, 5½ by 8 inches. Published by Harper & Bros., 49 E. 33rd St., New York City. Price, $4.

Because of the vital importance of a knowledge of patent law to business executives in all lines of industry, this book should be of considerable interest. The author has presented, in a simple and readable way, information that will be of value both to the inventor and to the executive. He discusses the protection of inventors' ideas, the proper relation of the corporation to those who work in its research laboratories, procedure in procuring patents, ways of stimulating new inventions, etc.

SAFETY AND PRODUCTION. 414 pages, 6 by 9 inches. Published by Harper & Brothers, 49 E. 33rd St., New York City. Price, $5.

This book contains the results of an engineering and statistical study of the relationship between industrial safety and production, made by a committee of the American Engineering Council. The information is based on data obtained from a vast number of plants in various industries. The text is divided into three parts, the first of which contains a statement of the problem, findings and recommendations of the committee, and a convenient digest of the report. The second part gives a resume of the investigation on levels of performance, accidents in terms of production, and individual accidents. In the third part of the book, the data obtained from each different industry is presented in a separate chapter.

THE ABRASIVE HANDBOOK. By Fred B. Jacobs. 547 pages, 6 by 9 inches. Published by the Penton Publishing Co., Cleveland, Ohio. Price, $5, postpaid.

This work comprises a complete handbook on the manufacture and application of abrasive material. It covers all phases and uses of abrasives, both natural and manufactured, together with all grinding processes used in up-to-date production, and includes a complete list of abrasive producers. The book points out how many classes of work can be ground advantageously, and answers many questions which confront the users of abrasive materials or grinding machines. It includes all the compositions of abrasive material, and gives standards, weights, formulas, solutions, etc. The text is divided into fourteen sections covering the following subjects: Abrasive Materials; Abrasive Paper and Cloth; Abrasive Producers; Cylindrical Grinding; Diamond Data; Disk Grinding; Grinding Machines; Grinding Practice; Grinding Wheels; Honing Practice; Miscellaneous Abrasive Data; Miscellaneous Abrasive Operations; Polishing and Buffing; and Safe Operation of Wheels.

NEW CATALOGUES AND CIRCULARS

ELECTRIC EQUIPMENT. Electric Controller & Mfg. Co., Cleveland, Ohio. Circular descriptive of E. C. & M. magnetic controllers.

MOTORS. General Electric Co., Schenectady, N. Y. Bulletin GEB-63, containing a brief review of the standardization of type MD-400 mill motors.

ELECTRIC FITTINGS. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2111, listing plugs

For Better and Faster Polishing

HIGH production, high quality polishing requires an abrasive of a high degree of uniformity—an abrasive without flats and slivers—without the long, weak grains that readily fracture and break down.

Norton improved sizing methods, with the most modern equipment, assure for Alundum Abrasive a new standard of uniformity. There are no large, over-size grains to scratch and mar the finish—no small, under-sized grains that fail to do their share of the work. And the grains are not only uniform in size but in strength and shape as well.

Trial samples will be gladly sent upon request.

NORTON COMPANY
WORCESTER, MASS.

New York Chicago Detroit
Philadelphia Pittsburgh Hartford

Norton Company of Canada, Ltd.
Hamilton, Ont.

NORTON
POLISHING ABRASIVES

W-187

and receptacles for extension cable connectors and conduits.

ALLOY STEEL. The International Nickel Co., 67 Wall St., New York City. Nickel steel pamphlet No. 12, entitled "Alloy Steel for Boiler Construction."

COUPLINGS. Charles Bond Co., 617 Arch St., Philadelphia, Pa. Circular descriptive of the Mather flexible insulated coupling for light loads and fractional horsepowers.

TURRET LATHES. Jones & Lamson Machine Co., Springfield, Vt. Bulletin containing a production report on the machining of sucker rod joints on a J & L two-spindle turret lathe.

BALL BEARINGS. T. B. Wood's Sons Co., Chambersburg, Pa. Bulletin 369, illustrating the Wood-Fafnir line of ball bearings hanger boxes. Dimensions and list prices are included.

HOLLOW BALLS. Hollow Ball Co., Inc., 210 W. Lexington St., Baltimore, Md. Circular outlining the advantages of "Holbols"—hollow seamless metal balls for use in pumps and valves.

LUBRICATORS. Madison-Kipp Corporation, Madison, Wis. Catalogue descriptive of the advantages and application of Madison-Kipp fresh oil lubricating systems on machine tools and engines.

CHUCKS. Westcott Chuck Co., Oneida, N. Y. Catalogue 528, containing information on the Westcott line of lathe and drill chucks, including dimensions, price lists, and complete specifications.

SAWS. Guaranteed Products Co., 102 Colfax Ave., E., South Bend, Ind. Bulletin illustrating and describing the "Zip-cut" portable utility saw, which may be used for cutting metal, wood, or carbon.

HEAT-TREATING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Heat-treating series No. 11, dealing with tempering, and illustrating and describing Homo installations for tempering.

STEAM TURBINES. Murray Iron Works Co., Burlington, Iowa. Bulletin T-101, illustrat- and describing Murray-Standard turbines for generators, pumps, fans, blowers, line-shafting, and miscellaneous machinery.

UNIT PULVERIZERS. Grindle Fuel Equipment Co. (Subsidiary of Whiting Corporation), Harvey, Ill. Bulletin 9, describing the advantages and operation of the Grindle multi-stage unit pulverizer for pulverizing coal.

NICKEL CAST IRON. International Nickel Co., Inc., 67 Wall St., New York City. Circular outlining the important characteristics of nickel iron castings and illustrating their use in the valve sleeves of automobile engines.

OIL BURNERS. Oil Heating Institute, 420 Madison Ave., New York City. Catalogue containing information on oil heating systems, and illustrating various types of oil burners both for residential and commercial purposes.

MATERIAL HANDLING EQUIPMENT. Elwell-Parker Electric Co., Cleveland, Ohio. Catalogue 150, covering the Elwell Parker line of "Tructors," which includes electric storage battery industrial trucks, tractors, and cranes.

ELECTRIC EQUIPMENT. Hobart Bros. Co., Troy, Ohio. Catalogue containing data on HB battery chargers, electrical testing equipment, automatic air service, spray painting equipment, ball-bearing buffers and grinders, etc.

MAGNETIC CLUTCHES. Magnetic Mfg. Co., Milwaukee, Wis. Bulletin 72, covering "High-duty" magnetic clutches. In addition to a detailed description of these clutches, a table of horsepower, ratings, and dimensions is included.

MOTORS. Louis Allis Co., Milwaukee, Wis. Bulletins 502A, 504, 505, and 506, illustrating and describing, respectively, the L. A. inverted rotary convertors; slip-ring motors; squirrel-cage motors; and single-phase squirrel-cage condenser motors.

FOUNDRY EQUIPMENT. Whiting Corporation, Harvey, Ill. Bulletin 186, entitled "Charging Cupolas by the Whiting Wishbone System." Bulletin 187, entitled "Pour Off with Safety!" descriptive of Whiting helical-worm geared ladles.

ELECTRIC LIGHTING EQUIPMENT. Cooper Hewitt Electric Co., Hoboken, N. J. Calendar for June, 1928 to May, 1929, illustrating on each page installations of Cooper Hewitt lighting equipment in various types of industrial plants.

PORTABLE FLOOD LIGHTS. Oxweld Acetylene Co., Carbide and Carbon Building, New York City. Pamphlet illustrating the use of the "Carbic" portable flood light in various classes of service, and giving specifications for the different styles.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Booklet containing dimensions, load data, and price lists of New Departure ball bearings, including double-row, single-row, "Radax," magneto, oil shield, and front-wheel bearings.

PORTABLE GRINDING UNITS. Stow Mfg. Co., Inc., Binghamton, N. Y. Bulletin No. 500, illustrating and describing Stow flexible shaft equipment for use in combination with tools of various kinds, and the Stow gasoline-driven portable unit for grinding.

STEEL. Firth-Sterling Steel Co., McKeesport, Pa. Booklet descriptive of "Circle C" steel, a high-speed steel for cutting the harder metals. The bulletin gives the results of tests made on this steel, and describes the classes of work for which it is best adapted.

POWER TRANSMISSION EQUIPMENT. Ramsey Chain Co., Inc., 1039 Broadway, Albany, N. Y., is issuing a publication known as the "Ramsey News," containing information relating to Ramsey silent chains for industrial power transmission, automotive drives, etc.

PLIER-WRENCHES. Kant-Slip Plier & Wrench Co., 428 W. Sixty-fifth Place, Chicago, Ill. Leaflet descriptive of the "Kant-Slip" open-end self-adjusting plier wrench, which is designed with a cam-wedge action that gives a strong gripping power and prevents slipping.

BAKELITE. Bakelite Corporation, 247 Park Ave., New York City. Booklet entitled "Bakelite Laminated," illustrating and describing the manufacture, properties, and uses of Bakelite Laminated, with special chapters on Bakelite Laminated gears and directions for working this material.

CRANES AND HOISTS. Box Crane & Hoist Corporation, East Ontario St. and Trenton Ave., Philadelphia, Pa. Pamphlet entitled, "The Box Line," briefly describing this company's line of type C electric traveling cranes, hand-operated cranes, and the complete line of "Load Lifter" electric hoists.

BALL BEARINGS. McGill Metal • Co., Valparaiso, Ind. Catalogue containing complete data on Schubert ball bearings of the radial, angular contact, and thrust types. In addition to a general description of these types of ball bearings, tables of load capacities, dimensions, prices, etc., are given.

LEATHER PACKINGS. E. F. Houghton & Co., Third, American and Somerset Sts., Philadelphia, Pa. Circular describing the characteristics of "Vim" leather packing, and giving information on troubles encountered in the use of leather packings, as well as means of avoiding the difficulties mentioned.

BEARING METALS. A. W. Cadman Mfg. Co., Pittsburgh, Pa. Engineering bulletin M-1 entitled "Cadman Metals," covering requirements of bearing metals, properties of Cadman metals, and their use for die-castings. Engineering bulletin M-2, containing a general treatise on bearings and bearing metals.

HOISTS. Union Mfg. Co., New Britain, Conn. Circular illustrating a new line of Union chain hoists manufactured by the company and embodying a number of improved features, including roller bearings, alloy steel cut gears, improved hooks, all-steel suspension, and visible self-closing and self-cleaning oilers.

TAPS AND DIES. Bay State Tap & Die Co., Mansfield, Mass. Catalogue 28, containing dimensions, price lists, and other data on the line of taps, dies, and screw plates made by this company. The catalogue also contains a section of useful tabular matter, including commercial thread dimensions and tolerances for taps.

STEEL. Gunite Corporation, Rockford, Ill. Circular describing the characteristics of "Gunite," a new graphitic steel. The circular shows photomicrographs of this new steel, compared with photomicrographs of ordinary gray iron and high-carbon steel. It also lists the applications for which the new material is particularly suitable.

BALL BEARING ELEVATING EQUIPMENT. Henry B. Newhall Corporation, New Jersey Foundry & Machine Co. Division, Garwood, N. J. Circular illustrating rope drum hoists with roller-bearing boxes, roller- and ball-bearing cranes, portable elevators equipped with roller bearings, I beam trolleys equipped with Timken bearings, etc.

HERRINGBONE GEARS. W. A. Jones Foundry & Machine Co., 4409 W. Roosevelt Road, Chicago, Ill. Catalogue 36, describing an improved method of generating herringbone gears. The booklet shows tooth forms, and gives dimensions and price lists of cast-iron and steel gears for recommended face widths, as well as horsepower tables.

TAPS AND DIES. National Acme Co., Cleveland, Ohio. Booklet covering the entire line of "Namco" opening dies and collapsing taps. The booklet contains lists of parts for these tools, describes their outstanding features, and gives information about special chasers. It also contains a preliminary announcement of a new "Namco" chaser grinding fixture.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Circular entitled "Yes, Sir—it is the Simple Truth!", dealing with the application of ball bearings to the main spindles of grinders, lathes, and milling machines for the purpose of securing accuracy of the work. The circular also illustrates a test made to show the strength of New Departure steel balls.

TUBE COUPLINGS. Parker Appliance Co., 10320 Berea Road, Cleveland, Ohio. Bulletin of Parker tube couplings, containing complete specifications of the standard shapes. Pamphlet containing specifications and instructions for the installation of Parker tube couplings and copper tube in buildings, power plants, and similar structures. Price list No. 11 of standard shapes of Parker tube couplings.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Sheets for loose leaf catalogue, covering magnetic switches; low-speed synchronous generators; controllers; arc welders and welding equipment; relay panels; air compressors; induction motors; mechanical drive turbines; rheostats; crane and hoist motors; drum-type switches; solenoid brakes; pot-type electric furnaces for cyanide hardening, etc.

PIPE THREADING MACHINERY. Landis Machine Co., Waynesboro, Pa. Catalogue No. 31, illustrating and describing pipe threading and cutting machines, pipe and nipple threading machines, and chaser grinders. A special section deals with Landis chasers and die heads of both the stationary and rotary types. The catalogue also contains tables covering Briggs standard and Whitworth standard pipe threads, and a table of cutting speeds for various diameters of pipe from 1 to 20 inches, inclusive.

TWIST DRILLS. National Twist Drill & Tool Co., Detroit, Mich. Booklet entitled, "A Quarter of a Century," calling attention to the fact that the present year marks the twenty-fifth anniversary of the starting of the National Twist Drill & Tool Co., which has, from a modest beginning in the small tool field, gained its present position as a manufacturer of a complete line of high-speed metal-cutting tools. When the company was formed twenty-five years ago, high-speed steel had just made its appearance and the founders started, in a small plant, to experiment with the new high-speed steels for the making of tools and drills.